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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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AN announcement was made in the papers a few days since that the Boston Museum of Fine Arts had purchased property on the Back Bay Fens with the intention of abandoning its present location on Copley Square. This change will cause a great deal of regret to those who have watched the development of Copley Square from a mere marsh to one of the finest architectural centers in the country; but the change is one which could have been foreseen, and is due entirely to the encroachment upon the museum property by high buildings on two sides. The museum will be far better placed in its new location, will be entirely isolated, and will have ample grounds on all sides, so that the danger from fire is reduced to the vanishing point; and while Copley Square will suffer by the loss, the inexorable march of business development is such that the change was bound to come sooner or later. We can only hope that the building which takes the place of the present art museum may be of at least a semi-public nature rather than carrying out the lines of the apartment houses which are already too much in evidence in that locality.

In this connection it is of interest to recall a little of the history of the art museum building. This structure was erected in the seventies, at a time when architecture in burnt clay was just beginning to be developed in this country. The architects were Sturgis & Brigham. It is built entirely of brick and terra-cotta, with the exception of a very little stonework about the base, the body being in the familiar old shade of Philadelphia Peerless Red Brick, and the trimmings in a lighter shade of terra-cotta. At that time the resources of the country were not sufficient to satisfy the exactions of a building of this kind, at least it was so considered, for all the terra-cotta was made in England and imported to this country. As far as relates to mere material, the terra-cotta is about as good as anything that was ever done in this country. The matter of design is a somewhat different question. When it was built the country was in the last throes of English Gothic revival, and the influence of South Kensington work was paramount, and consequently the museum was designed in a species of Gothic which might perhaps fairly be termed a cross between early English and the style of the Orvieto Cathedral. It is quite safe to assume that when the designs for the new building are put forth they will show a building in the style of the Renaissance rather than carrying out the features of the present building, and it will be of interest to compare the new building with the present one, and to mark what progress has been made in the art of architecture during the last quarter century.

IN the good old days when a brick was a brick, and superlative worth was assumedly implied by the designation, the qualities which were deemed necessary for enduring work in burnt clay were little considered. In modern times, with the advent of numerous short-cuts toward speed in manufacture, no less than because of the indifference of poor workmen, the quality of terra-cotta has to be very carefully considered. All burnt clay is by no means good, and some terra-cottas which have every appearance of being thoroughly well burned and sufficiently hard for building purposes are in reality quite the reverse. It behooves all those who are to use this material to not only exercise care in the determination of the color and design, but to make a selection of the best manufacturers, limiting the choice to those whose product has been tried and proved satisfactory. For while terra-cotta at its best, or even the average terra-cotta, can be thoroughly depended upon for all emergencies, the temptation to use inferior earth or insufficient methods of burning is great enough to lead to pretty serious results with careless or dishonest manufacturers. Good terra-cotta ought not to scratch at the point of a knife, nor be influenced by the strongest acids, and it ought to give a thoroughly clear, bell-like ring when struck hard with a hammer. We have seen pieces of burnt clay so soft that a knife could be stuck right through an inch piece.

WHILE terra-cotta is one of the oldest of building materials, its use at the present day involves entirely new considerations. The North Italian work, for example, is built into the wall in much the manner stone is employed, the work being laid out in courses and bonded into the construction in such manner as to be entirely self-supporting. The advent of the steel frame, however, has so thoroughly changed all this that he who uses terra-cotta now is obliged to resort to schemes of balancing and tying together, which are entirely at variance with the constructive spirit of the old work. In other words, in our steel frame buildings, the terra-cotta is no longer a constructive member, but rather a decorative covering, and it has to be treated as such, and put together with the utmost care. We have at different times illustrated in these columns the construction of several of the more modern buildings, showing how thoroughly each piece has to be ironed to the frame and independently supported. It is an interesting study and one which brings dire results if neglected, and it speaks well for the care with which our hastily constructed modern work is put together that so little of the terra-cotta comes to grief.

WE had recently an illustration of the relative values of old and new work. A building which had been standing for about sixty years, and was consequently built in the period of our architectural development when it was assumed that good honest masonry was the rule, recently underwent some alterations, in the course of which it became advisable to remove the outer casing of brick wall and substitute therefor some light-colored face brick. It was found that the outer 4 ins. of the old work was laid up not only without the slightest kind of backing, but was in many cases entirely free from the rest of the wall, so that a crowbar put in behind the lining would pry off huge slabs of the face brick in one piece. In opposition to this, a wall which had been built only a few months, in connection with the same building, was found to overlap the lot line to a certain extent, and it became necessary to remove the outer 8 ins. of it. Although the wall was not supposed to be a specially good wall, but simply built up as one would ordinarily construct such work nowadays, it was found that nearly every brick had to be broken away or forcibly detached from the backing. The mortar had set up so hard it was almost impossible to drive a nail into a joint without bending and the face of the wall was, as it ought to be in all work, an integral part of the whole. We certainly do some things better than our forefathers.

WE have been interested in noting the extent, as evidenced by our correspondence, to which enameled brick has been recognized of late years as a highly desirable adjunct of modern interior work. Its cleanliness, as well as its attractive appearance, commends itself so thoroughly to all who have occasion to use it that the only surprise is that its use is not even more extended. We have just received specifications of a large, sumptuous palace to be erected by a well-known millionaire upon one of the best sites of New York. All the walls of the boiler and engine rooms from floor to ceiling, all the street area walls, the walls and ceilings in steam room in the Turkish bath, and the entire floor and wall lining of the swimming bath, occupying one end of the basement, are to be lined with enameled brick, as well as all the ceiling arches in basement, the iron beams of the construction being protected by enameled brick accurately fitted around the lower flanges. Also enameled brick are specified on all walls from floor to ceiling in machinery room, kitchen, scullery, servants' room, servants' dining room, cloak room, toilet and entrance service corridors, laundry, service stairs, and walls of kitchen elevator shaft. Though this is a somewhat extreme example of the lavish use of this material, we have received letters showing that it is by no means uncommon in New York, and we trust it will soon be the rule throughout the country generally to use enameled brick or tile exclusively for the service portions of every first-class dwelling. It goes without saying that this is really the only material that is applicable for such purposes.

ONE of the fallacies which seems to have been inherited as a part of our structural development is that cement can fairly be tested by subjecting to a tensile strain. Judging by personal experience, the test for fineness is the only one which the architect can make with any certainty. If the cement is properly ground no test applied at the building will indicate very much, for we have repeatedly seen instances of cement which after twenty-four hours set under water would not give a tensile strain of 40 lbs. to the inch, and yet within a few weeks would set up so hard in the wall that it could hardly be touched with a chisel. We have found the natural cements as a whole are less reliable now than they were twenty years ago. The processes of manufacture have so enormously increased the output that it stands to reason a great deal of inferior cement is put upon the market, and the only safeguard to the architect is to insist upon cement being thoroughly ground, and of a brand which he has actually used and has found of proper quality, not as a result of tests in the laboratory, but by actual use in building.

THE extent to which the native laborer is being replaced by the Italian emigrant is something quite noticeable of recent years. The Irishman, who fifteen or twenty years ago was the typical hod-carrier, has in some parts of the country almost disappeared, and it is by no means uncommon to find large gangs of Italian masons employed on large buildings. We seem to have noticed one peculiarity of the average Italian mason, namely, that he can be depended upon to fill the joints of stonework. This was manifested in connection with the cellar wall of a country house, where of all the masons employed only one was Italian, and he the last comer, but there was a noticeable difference between his work and that of the other men, for while the choice of stones and bonding of the wall was not attended to as carefully by him, and while he was less particular about making the work straight and pointing up nicely and smoothing over the irregularities of the outside, he built up a really better wall, and every joint and seam was filled full of mortar. It was a rough looking wall when done, but stronger and much more likely to stand than the work of the average mason, who lays the stones almost any way, and then points up a little from the outside.

NEW BOOKS.

CHIMNEY DESIGN AND THEORY. A book for engineers and architects. By William Wallace Christie. New York: D. Van Nostrand Company. 1899. Price, $3.00.

Up to the present time there has been but one book on the subject of chimneys printed in the United States, and outside of this country the only other book of any pretension is an English work, dating from 1885, and no longer obtainable. A work, therefore, which contains the latest practise in regard to theory and design of chimneys as built in the United States is of timely importance. Such a work is now before the public. It is not a book which one would need for daily practise, but it is something like a Texan's revolver, and judging from its contents would prove exceedingly valuable when wanted. It is a volume of a little over one hundred and fifty pages and goes into all the details which one would need to consider in work of this sort.

A TREATISE ON MASONRY CONSTRUCTION. By Ira O. Baker, C. E. Ninth edition revised and partially rewritten. Price, $5.00. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1899.

Professor Baker is one of the best authorities on masonry construction, and the ninth edition of his treatise upon the subject, which we have just received, forms a valuable addition to the architect's library. This edition is considerably extended, with several new chapters; the chapter on concrete having been rewritten and nearly doubled in extent. It includes, among others, some very careful studies of the relative economy of natural and Portland cement, these considerations being based upon a large number of experiments. The work is standard of its kind.

HOW TO USE PORTLAND CEMENT: From the German of L. Golinelli. Translated by Spencer B. Newberry, E. M., Ph. D. *Cement and Engineering News*, Chicago. 1899.

The *Cement and Engineering News* has issued a translation of a small circular on the topic of "Portland Cement," which was prepared some years since by the Association of German Portland Cement Manufacturers and distributed as a tract. This is a subject regarding which a great deal has been published, and it is to a certain extent a perennial theme; but our observation tells us that the last word has by no means been sounded on the subject, and every addition to our practical knowledge of the use of this so important building material is of great value, and this pamphlet, which claims to represent the latest German thought on the subject, will undoubtedly be of interest and value to contractors in this country.

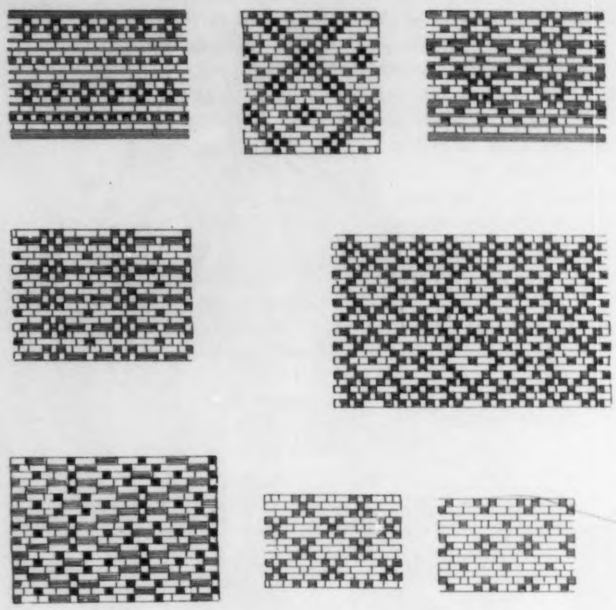
The Minor Brick Chateaux of France.
I. The Gothic.

BY WILLIAM T. PARTRIDGE.

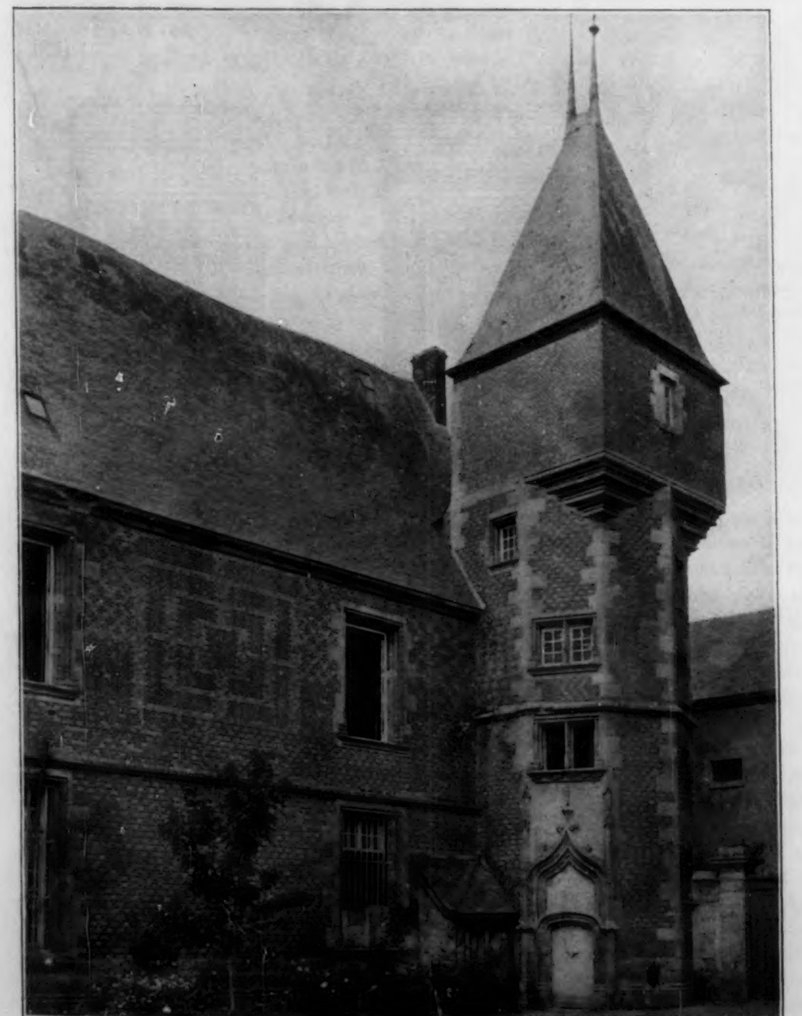
ALTHOUGH burning clay to make a sort of artificial stone has sooner or later been practised in almost all countries, this art really found its first development in alluvial regions, where real stone was hard to obtain, such as the valley of the Tigris and of the Euphrates. In the same way we naturally look for the first and best examples of its artistic employment, during the Middle Ages and the Renaissance, in Italy, in the valley of the Po, and in France, in Languedoc, and Provence.

Here, in the Cathedral of Toulouse and Albi, are the beginnings of a brick architecture which found a later and more modest development in the farm and smaller châteaux of Normandy.

These buildings were constructed entirely of brick,— walls, vaults, and buttresses,—but in other words the material is used mainly constructively, little advantage being taken of its plastic capabilities or of its color. Stone was employed both for decorative details and for reënforcing or bonding the walls and piers. If the builders considered its color or texture at all, the irregularity with which it was combined with the brick makes one think they were aiming at picturesqueness. Later, in the time of the Renaissance, these bond



BRICK PATTERNS AT TROYES.



CHATEAU DE GIEN.

courses of stone were used decoratively, but in the Gothic buildings, as, for example, the *Couvent des Jacobins*, at Toulouse, the walls are entirely of brick, the only stone used is that about the entrance doorway.

The bricks used during the early part of the Renaissance were light red in color, 10 ins. to 13 ins. long, 2⅛ ins. high; and in the courtyard of the *Hôtel des Raisins*, at Toulouse, are laid with wide, tucked, horizontal joints, and thin vertical ones, the warping of the long bricks making a wavy line, which gives to the surface much the same charm that a free-hand line gives to a drawing. They are all laid as stretchers in this example, and as the bricks vary in length, the vertical joints fall irregularly. The stone used about the doors and windows is bonded but slightly into the brickwork, which produces a very delicate effect. The angle bricks seem to have been especially shaped for their position.

In the time of the later Renaissance, color seems to have been taken into account. Bands of stone break the surface and the bonding of the stone around the openings is carried far into the surface of the brickwork. Brick molded architraves are used in the museum here; the applied orders in the courtyard are constructed entirely of brick.

The surfaces of these walls at Toulouse are of one color save where stone is used as a contrast. Nowhere is found a pattern formed by darker or colored brick.

But at Bourges the wall of the *Hôtel Cuja* is laid in headers and is ornamented by a simple diaper, formed with blue-black brick. The door and window jambs are of stone bonded in the wall to some depth, but with no regularity. The joints are thin the bricks small, and the decorative effect is due entirely to the pattern in darker colors.

In the south the dwellings are in general confined to the cities, and built around courtyards or between party walls, while the north abounds with châteaux built sometimes near the large cities, but no insecurity was felt in a situation quite remote.

CHATEAU DE MARTAINVILLE.

At Gien, now nearer the center of France, is a Gothic château of considerable size where the entire wall surface is covered with varied patterns laid in a bond of alternate courses of headers and stretchers. The first story is decorated with a simple pattern formed by making every other header a dark brick. The system is reversed every three or four courses, so that no vertical lines are carried through the pattern continuously. The upper stories are decorated on this large surface with a variety of geometrical figures, squares, circles, etc., and the smaller areas filled with an endless number of diapers, zigzags, and other patterns. The scale of this decoration is so great as to impair the dignity of the architecture.

In these illustrations the red of the brickwork has photographed darker than the blue-black pattern, so that one must reverse the colors in one's mind.

Coming suddenly upon brickwork patterns in such quantity and of such boldness, one asks their origin. In portions of the fortifications of Troyes, in the central part of France, where the caravans from the Levant ended their journey, there existed as late as the year 1859, walls and towers of brick ornamented with patterns of endless variety. They were formed in dark and light brick, and in stone or chalk. They are known to have been in existence in 1542, and tradition traces them back to Byzantine times. Certainly no modern military engineer would so have decorated a work of defense. It is not unlikely that this wealth of detail, existing at so important a point, may have had great influence upon the brick architecture further north.

In Normandy, a great wealth of material awaits the student. Brick manors and châteaux abound. The colors of the brickwork give them an air of gaiety, which made it a favorite material in both the Gothic and the Renaissance period. In the smaller châteaux one can trace all the features of the larger ones, and the same plan was retained down to the time of the late Renaissance. The central staircase was then a mere tradition recalled by a slight break in the center of the façade crowned with a pediment. The bold corner towers shrank to small, corbeled turrets or slightly advancing wings.

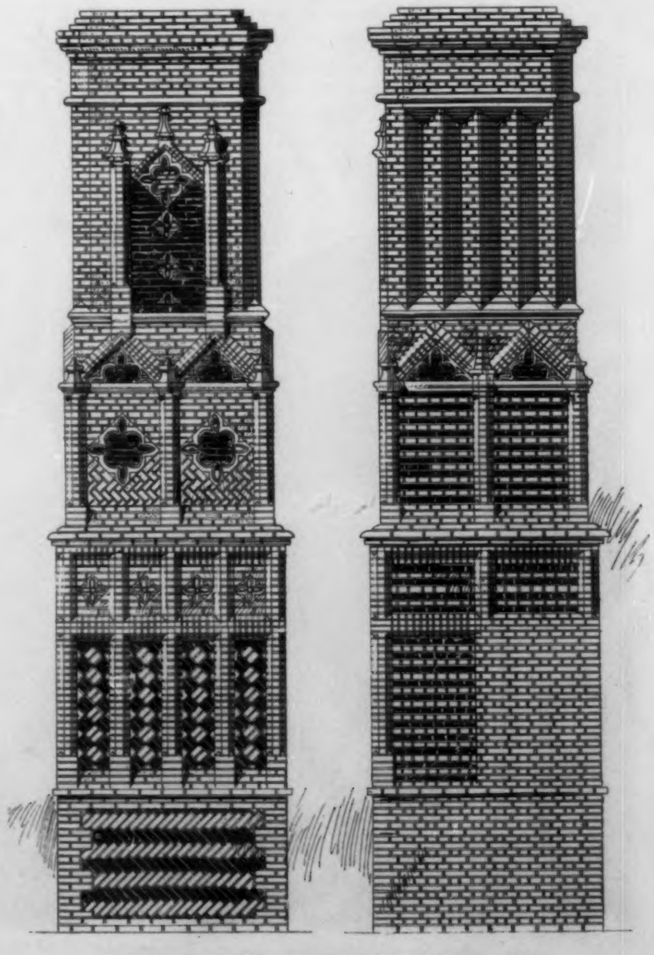
The use of brick in the construction of the late Gothic châteaux had but little effect upon their architectural forms. Brick was used strictly as a constructive material, though advantage was taken of the great variations in color possible to this material, and of its contrast to the light color of the Caen stone used throughout Normandy.

The pointed arches of the earlier Gothic work had, by the time the use of brick became general, degenerated into a low ellipse, around which all the moldings of the jamb were carried. In construction this was practically a flat arch, and the lintel which finally replaced it still carried all the moldings of the jamb, which instead of mitering either turned a quarter circle, or intersected in the complex manner so characteristic of the Flamboyant style. The corbels, dormers, and gables, and the enriched heads of the doors, as well as the sections of the moldings, all show the stone forms of Gothic domestic work without a trace of any influence from the new material.

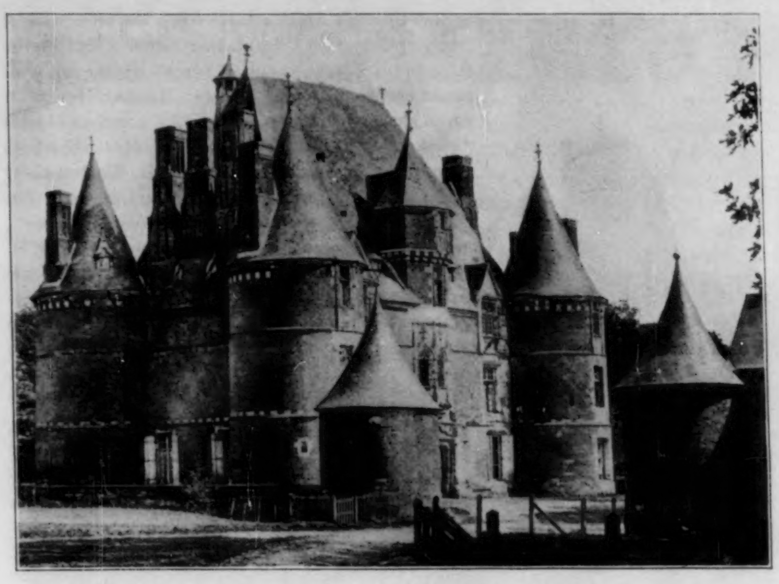
There are no molded brick such as are found in the later work of the south; the few that are used in the chimneys have simple sections of a half or quarter circle. A few small turrets are laid in bricks especially formed for the purpose, but the diameters of the larger towers were so great as not to require a special mold. Lime mortar was apparently in universal use.

The roofs and the finials and crestings are made of lead. Only in work of later date do glazed terra-cotta finials appear.

The mercantile class following in the sixteenth century close on the heels of the soldiers spread their small châteaux everywhere throughout Normandy, and in none of these is this type of dwelling better shown



BRICK CHIMNEYS, CHATEAU DE MARTAINVILLE.



CHATEAU DE MARTAINVILLE.

than in the charming *Château de Martainville.* It stands in the midst of an enclosure once defended by a high, brick wall, reënforced by towers at the angles and protected by a moat. Little remains of the defenses, though the château itself is in fair preservation. It was built in the year 1485, by a merchant prince, Jacques le Pelletier, and is for its size one of the most interesting Gothic dwellings in France. A vaulted corridor extends from front to rear, ending at the staircase, which is enclosed in a projecting tower. To the left of the entrance is a large hall, to the right the guard room and kitchen. Above the entrance is the chapel, extending out over the doorway in a little corbeled bay or oriel, with a richly decorated window with tracery.

The rooms grouped on either side of the central passage form a parallelogram unbroken by the towers placed at the corners, the rooms projecting into the circles of the four towers. The planning of the rooms, the arrangement of the fireplaces, doors, and windows is unusually symmetrical.

The four corner towers, which loopholes for muskets show to have been built for use as well as for ornament, the staircase cage, and the chapel oriel are roofed with high, conical or pyramidal roofs which are united into a single composition by the towering roof of the main building.

The château is built throughout of brick laid in alternate courses of headers and stretchers. Stone string courses mark the floor levels, while the base is constructed with alternate masses of brick and stone arranged like a checkerboard. The first story is without ornament, but the upper walls are decorated with diapers of varied design, but so faded as to be hardly discernible. Above the first-story string and under the eaves, a course of isolated blocks of stones add variety to the large wall surface.

The dormers have suffered the loss of their traceried gables, but much of the brickwork of the chimneys remains.[1]

If Martainville and Gien represent the maximum of brickwork, the *Château d'O* and the *Château de Montigny* show the minimum. At Montigny the upper portion of the staircase tower and the band over the now obliterated arcade are decorated by square patches of brick and stone of the same size laid so they break bond. That is to say, the joint between two masses comes above the mass on block below. This gives a vertical zigzag pattern, which is hardly a success as a decoration. In the walls of the *Château d'O*

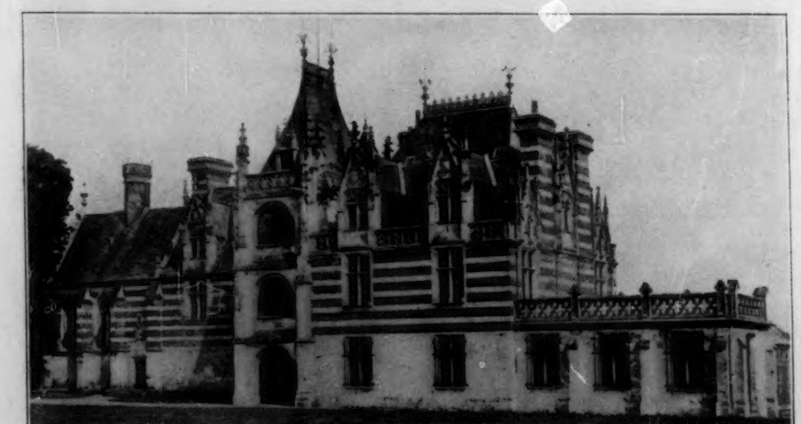
CHATEAU D'AUFFRAY.

brickwork was inserted in the same way wherever there was space for it, but the stones being irregular in length the effect in one portion is, strange to say, that of a graded wash with the smaller amount of color at the top.

The plans and masses of both of these buildings is quite irregular, but being each portions of a larger group the same observation as to traditions in the plans of the smaller châteaux is not.

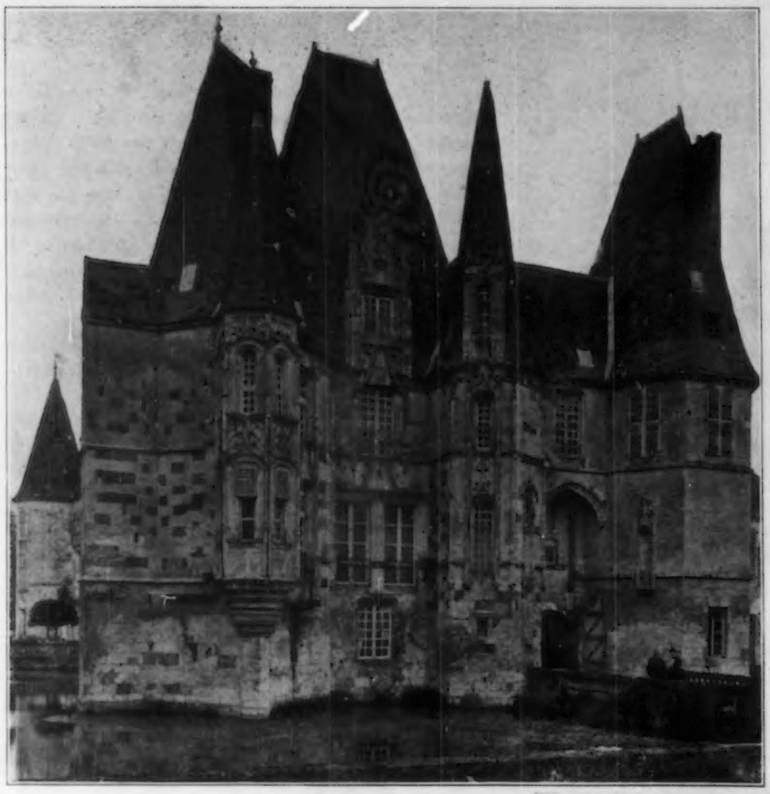
The *Château d'Auffray*, near Havre, though wanting in some of the features of Martainville, has the same general mass and plan, and was built about the same time, 1442, an inscription announces.

The entrance vestibule and corridor, like that of Martainville, is vaulted, but the workmanship is of a later date; there is a tradition that it is by one of the workmen of Chambord. The entrance façade



CHATEAU D'ETELAN.

[1] An interesting restoration of this château is published in *Sauvageot-Palais, Châteaux et Hôtels de France.* Vol. iv.



CHATEAU D'O.

has been altered, but beyond the cutting out of the mullions which nearly every Gothic domestic window seems to have suffered in the eighteenth century, the rear façade here shown is unchanged. Palustre, in his work on the French Renaissance, gives an illustration of the other front.

The wall decoration consists of broad bands of stone, alternating with wider bands of colored brick laid in different patterns. White, green, and black are employed, and from the picturesque standpoint, the charm of the composition is enhanced by the vine-clad tree.

The little château and chapel of *St. Maurice d'Etelan*, near Lillebonne, dates from the later part of the fifteenth century. The irregularity of its disposition is doubtless due to the difficulty of incorporating so large a chapel into the scheme.

The walls are decorated with broad bands of stone and brick with no string course. It is attractive from the picturesque staircase tower and dormers, but lacks the dignity of the more symmetrical buildings at Auffray and Martainville.

PERSONAL AND CLUB NOTES.

Higby Brothers, architects, have opened an office at 828 Ellicott Square, Buffalo, N. Y.

Amos S. Wagner, a prominent architect of Williamsport, Pa., died at his home in that place on Dec. 11, 1899, aged fifty-nine years.

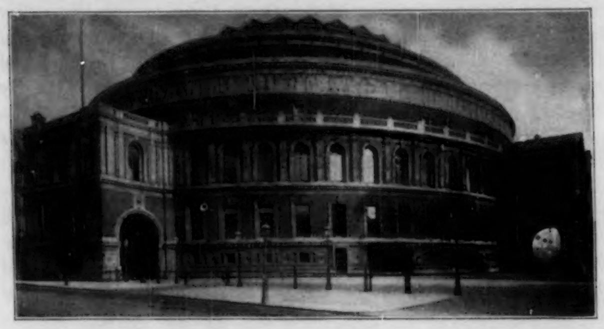
The Sketch Club, of New York, held its regular monthly meeting December 9, in the rooms of the Architectural League, 215 West 57th Street.

Mr. Edward J. Jones, Jr., exhibited recently at the Chicago Architectural Club his collection of foreign photographs, numbering in all about eleven thousand subjects. Other events at the club of recent occurrence are as follows: Monday, November 27, a turkey supper; Monday, December 11, a "smoker"; Monday, December 18, Mr. Robert C. Spencer, Jr., gave an informal talk illustrated by chalk drawings, on "Artistic Farm Houses." Mr. Spencer has made a special study of this subject, and his talk was especially interesting. Walter H. Kleinpell, a member of the club, has received from Pratt & Lambert the sum of fifty dollars, to be expended as prizes for the following competition, to be given under the general code governing competitions in design of the Chicago Architectural Club: A design for the full improvement of the triangular space, bounded by North State Street, Rush Street, and Bellevue Place, as a small park. The cost of any architectural features of the design must not exceed one thousand dollars, and designs the execution of which will evidently cost more than this sum will be ruled out. Competitors may make all use of foliage or shrubbery desired, as the cost of this part of the work will not be included in the one thousand dollars named.

CHATEAU DE MONTIGNY.

Terra-Cotta Architecture in England.

AMONG the first buildings of importance in London on which terra-cotta was introduced on its own inherent merits, the Albert Hall, Kensington, is worthy of mention. Whether fashioned into variously shaped blocks or laid up in the form of brick walling, the burned clay of which this immense auditorium is constructed was not chosen as a substitute for stone, nor is it treated in simulation of that or any other material. In trueness of line and evenness of color it does not approach the standard reached in work of later date, but there is a frankness and freedom from affectation about its make-up that is very engaging. The chief embellishment consists



ALBERT HALL, LONDON.

of a fine sculptured frieze around the rotunda, designed, we believe, by Edward J. Poynter, R. A., and dedicated to "the arts and sciences and works of industry of all nations."

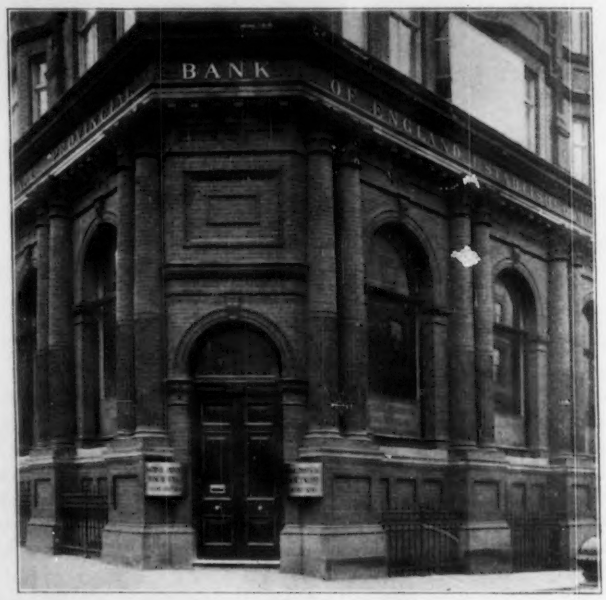
In referring to a few of the more recent examples of terra-cotta and brick architecture, it may be well to recall the chief points of difference between English practise and that to which we are becoming accustomed in America. The first and perhaps most noticeable of these is the absence of stone in the lower stories of all their buildings in which terra-cotta has been seriously introduced. With us there is a tacit understanding that while terra-cotta may be used above the second or third story, it will not do to challenge inspection at close quarters. The English architect contends that when deemed advisable to use it extensively on any part of the building, the quality and finish should withstand criticism down to grade level. On that point, at least, there seems to be a consensus of opinion; for, with the utmost variety of style and treatment in other respects, there is rarely an exception to the rule in prevailing practise. This is due in great measure to a higher appreciation of the material, based on a fuller recognition of its time and smoke-resisting qualities. It is usually

OFFICE BUILDING, PARLIAMENT HALL, LONDON.

well set, and, which is equally important, protected from injury until the building approaches completion.

Considerations such as these are forced upon one's attention in viewing any of the recent work to be met with in either the business or residential quarters of London. A tall office building on the east side of Parliament Street, of which we illustrate the lower stories, proved something of a revelation to the present writer. Everything is burned clay from sidewalk to the topmost finial, save the doorstep. The entrance itself, and indeed most of the work throughout the building, furnished a severe test of skilful workmanship. The lines are true, the joints tight and of uniform size, while the intersection of moldings could not be surpassed in the best stonework. The terra-cotta is gray and the brick red, the former having a close resemblance to the oolitic limestone from the Island of Portland, which has been found to stand the corrosive atmosphere of the great metropolis better than any other. There is a total absence of broken or patched arrises. Not a single chip had been knocked off any projecting member, which showed that they had been deemed worthy of protection during the progress of subsequent operations.

Most of the above remarks will apply to the terra-cotta on Redfern's building, which also begins at the sidewalk, including a balustrade placed there, we presume, to keep intruders at a respectful distance. The workmanship here, too, is in keeping with an establishment that set the pace many years ago in the world of fashion for fit and finish. Our photograph was taken rather early

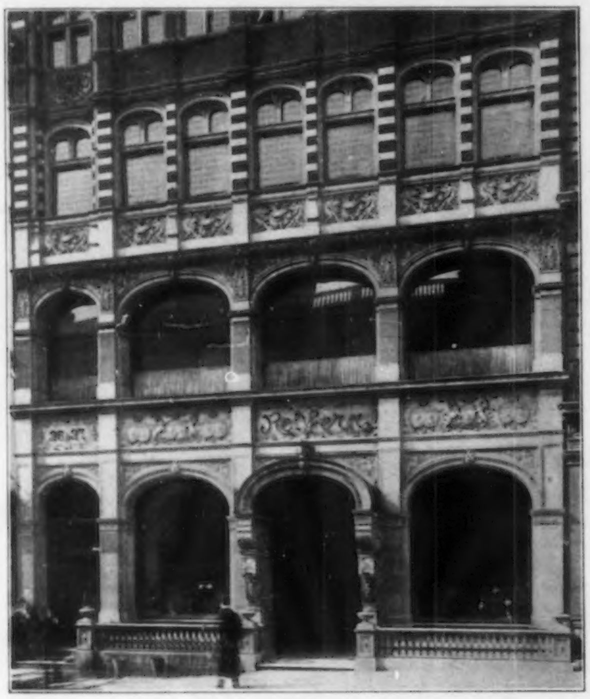


BANK BUILDING, OXFORD STREET, LONDON.

in the morning, before the carriage folk began to form in line along Conduit Street. Two window cleaners with pails and a hose had just finished washing down the lower portion of the frontage under the direction of the inevitable man in buttons. The building looked bright and cheerful after its morning bath, and thus the undeniable advantages of semi-glazed terra-cotta became obvious to the most casual observer.

The new Birkbeck Bank, just off Chancery Lane, approached by narrow streets and bounded by alleyways of time-honored antiquity, needed something to relieve the prevailing gloom of its immediate surroundings. To accomplish this, the architect has devised a color scheme made up of light brown, olive green, and white of a slightly pinkish cast. These colors are laid on in the form of an opaque enamel on a perfectly smooth surface obtained from a dense, finely ground body. To this is added a dull glaze, sufficient to seal up the pores and produce an impervious gloss without objectionable

glitter. The entire building is of terra-cotta, the interior being treated in a similar manner, lighted by an immense dome of steel and terra-cotta construction. When last seen the scaffolding had not been removed; but the result, so far as could be judged, appeared very encouraging from an architectural as well as from a terra-cotta standpoint. Though not by any means the first building on which a color scheme has been attempted, it is one of the most important,



REDFERN'S STORE, OXFORD STREET, LONDON.

and will, doubtless, be the forerunner of others in which a still greater degree of success may be achieved.

Another difference between English and American practise is noticeable in the surface finish, which in the former is perfectly smooth, while we insist upon its being tooled in imitation of stone. This, like many other minor differences between the two branches of the English-speaking people, is owing chiefly to climatic conditions. A smooth vitreous face affords less foothold for smoke, and what little does collect is easily washed off, after which the building combines the freshness of youth with the mellowness that accompanies its riper years. In the clearer atmosphere of America, the tooling has certain very decided advantages. It absorbs the light instead of reflecting it, and so conceals defects instead of exhibiting them in an exaggerated form. Yet in and around manufacturing centers, unrestricted in their use of soft coal, soot will adhere to rough surfaces and, when wet, run into streaks that are beginning to disfigure many recent erections on which light colors predominate.

In Heath's hat shop, on Oxford Street, no brick is used, the whole frontage being jointed up in terra-cotta blocks. Along the wide frieze over the store windows "Ye olde London hatters" are depicted in high relief, showing the processes of hat-making, from the preparation of raw material to the sale of the latest fashion in head covering. Beyond this, ornament in its usual acceptation is introduced somewhat sparingly. This studied severity will act as an offset to some work around Essex Street, Strand, on which it is perhaps a little too plentiful. The color is a warm shade of buff, of a fairly uniform tint, but hardly equal in that respect to the American standard as set by the best work of our leading manufacturers.

It is only fair, however, to allow in this connection that it is not "slipped," as is now the almost invariable custom with us. English architects, in addition to their share of national conservatism, have a strong prejudice against the application of anything to the surface of the block after it has left the mold. They prefer it trimmed and finished up by hand in its own clay; accepting, as a matter of course, the slight variation in color, so long as the body is the same throughout. An aversion to shams is always commendable and nowhere more becoming than in things architectural, but we think that that principle, good though it be, is carried too far in this particular. It dates from a time when unsuccessful attempts were made to apply a facing of fine clay by dipping the blocks into a slip. This face did not always adhere to the block after firing, and in most cases it evinced a readiness to part company on slight provocation. Our method of blowing an almost impalpable vapor against the face of the block, by means of compressed air, is different in principle and perfectly reliable in its results. This fine spray adheres to the dry clay, and when fired sinks into the pores as a stain, producing a uniform color, with a close vitreous surface, one and inseparable from the block so long as it endures.

There is a section of the city of which Mount Street, Grosvenor Square, is the center, and in it a high grade of brick and terra-cotta residences holds undisputed sway. So, too, along the great thoroughfare between Holborn Viaduct and Hyde Park. A branch of the National Provincial Bank, on Oxford Street, must be a veritable masterpiece in the art of brick building. Whether the architect has nursed a grudge against the existence of terra-cotta we know not, but he has evidently reserved his right to an unlimited use of burned clay in the form of bricks. With the single exception of the door-step, this building is built of brick. Panels, molded jambs, and

HEATH'S, CONDUIT STREET, LONDON.

column bases are of brick; the fluted columns are laid up in Flemish bond to correct entasis. The composite capitals and modillion cornice are brick; bonded, we presume, to approximate outline, and afterwards carved to the degree of perfection shown in our illustration.

Brickwork at the T Square Club Exhibition.

IF the contributors to architectural exhibitions could stand behind the scenes as the jury of selection is passing on their drawings, there would be an immediate and marked improvement in American architecture,—less straining after effect, more of the honest, unaffected work which is not conscious of itself. A gradual improvement in architectural standards, however, is indicated by each succeeding exhibition. Although those followers of the Beaux Arts School, who have gained the manner without the spirit, as their enemies claim, set a pernicious example, their excesses of trailing ornament and ponderous mass react against themselves. Even the commercial and untrained architect, to whom all design is an effort, has come to look at his work more soberly and to introduce some breadth and repose into it. The profession in general has become more interested in the small realities of office practise than in the gigantic school drawing. A good exhibition, like a substantial house, has a large part of it underground, and the tendency of elimination has been steadily to set aside the unreal for the actual, simple and genuine. Although there is a temptation in the facility with which terra-cotta can be wrought, to overcharge it with ornament, there is an inherent simplicity in brickwork, a homeliness and familiarity of effect, which make it the freest and most natural medium of architectural expression; and it is, therefore, in brickwork that the visitor at the exhibition is likely to find what is of genuine interest and practical value to him.

The T Square Club, having gone to considerable expense to procure foreign work through representatives abroad, there is an excellent showing at its annual exhibition in the Art Club of Philadelphia, of the designs of the best English architects—the men to whom within the last few years we have resorted for precedents in certain directions. The work of Ernest George, who has probably been the most prominent factor in our rediscovery of England, is represented by his characteristic sepia pen-drawings softened with the brush, an attractive process which we seem over-slow to learn for ourselves. The quality in his work, that of seeming not to have been actually built but to have grown up naturally from its surroundings, goes through all the English domestic work. The architects are not using an exotic and imported, but a familiar, national style; their box hedges and wicket gates are not merely a pleasant deception of rendering. There is every reason why the work should be spontaneous, and yet after leaving the charming cottages of Arnold Mitchell, for example, and the country residences like those of Ernest Newton, the Englishmen's treatment of brickwork in monumental structures is undeniably clumsy. They have constrained themselves to an affected *naiveté* and quaintness, which for the most part consorts well with smaller work, but in the solution of large problems loosens their grasp of the whole. They are attempting to work out a consistent style to its conclusion; on our side, we seem to be more at ease for taking the ancient styles in their most flexible forms and adapting them to modern uses.

COTTAGE AT RICKMANSWORTH, ENGLAND.
Arnold Mitchell, Architect, London.

Probably the most notable examples of American brickwork at the T Square Club exhibition are the two perspective views of the new dormitory buildings now in course of erection at the University of Pennsylvania, under Cope & Stewardson. The location offers excellent opportunities for picturesque composition. A horizontal range of dormitories after the Jacobean style, completing the "Triangle" constructed by the same firm several years ago, surmounts an arcaded terrace, at either end of which a monumental stair leads to archways, which are emphasized by a lofty ornamental treatment like the college gateways at Cambridge or Oxford; beyond, rise the clustered spires of the great tower and of the dining hall opposite. The same architects, who have had a long experience in college buildings at the University of Pennsylvania, Princeton, and Bryn Mawr, are now engaged, as winners of the recent competition, in making working drawings for

HOUSE, WOODSIDE, STANMORE, ENGLAND.
Arnold Mitchell, Architect, London.

HOUSE AT WOKINGHAM, ENGLAND.
Ernest Newton, Architect, London.

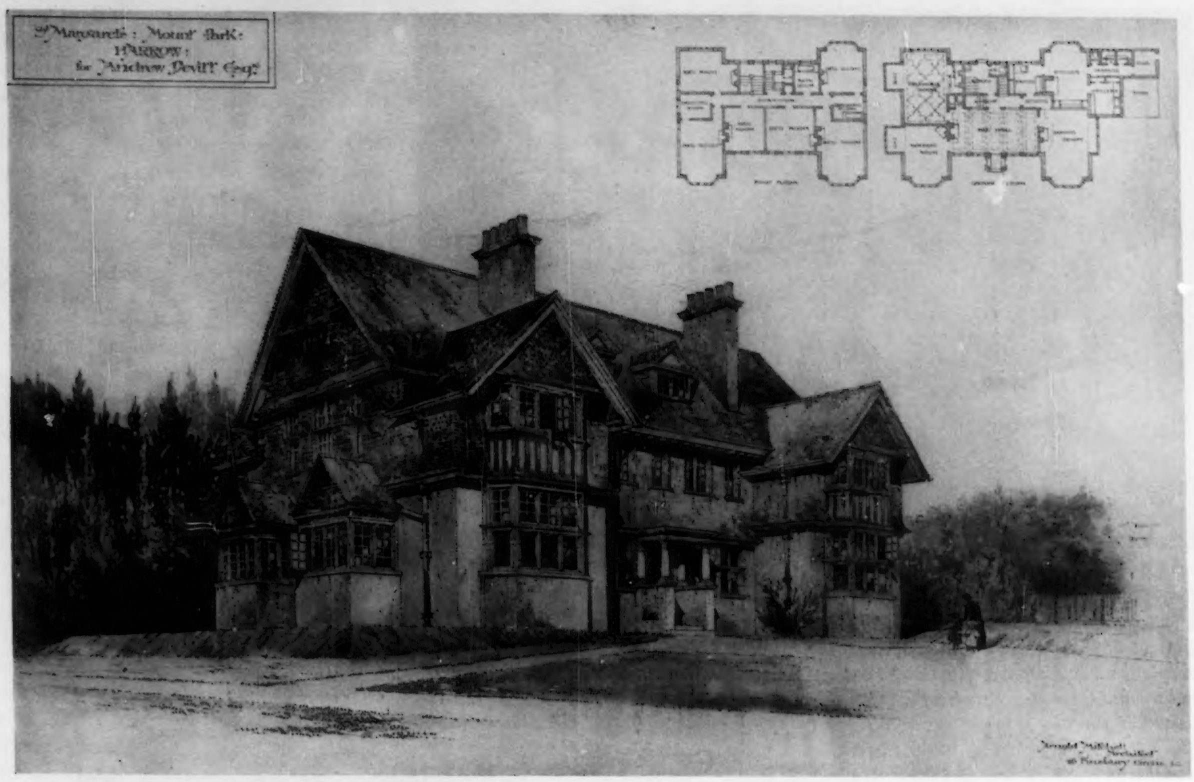
the preliminary buildings at the University of St. Louis. In the surgical operating building of the Massachusetts General Hospital, Messrs. Wheelwright and Haven present a striking example of bold, direct, and appropriate treatment. They, probably more than any others, have introduced into general practise the strong, full Georgian motives to take the place of emasculated colonial forms, and their work carries an unvarying high quality. Like all bold conceptions, this one is open to the criticism of disregarding formulæ. Timid ones are troubled about the use of the piers set diagonally on the corners, and as to what is the character of the roof hidden by the sharp perspective; but whatever fault may be registered against it, the building is straightforward and unequivocal.

An agreeable use of Georgian motives characterizes the suburban residence at Germantown, by Lawrence Visscher Boyd, and an adapted Tudor style the country house at Wayne, by W. L. Price, whose uniformly good work merits attention. Nothing is more hopeful for the future than the present decorative yet restrained treatment of American domestic architecture.

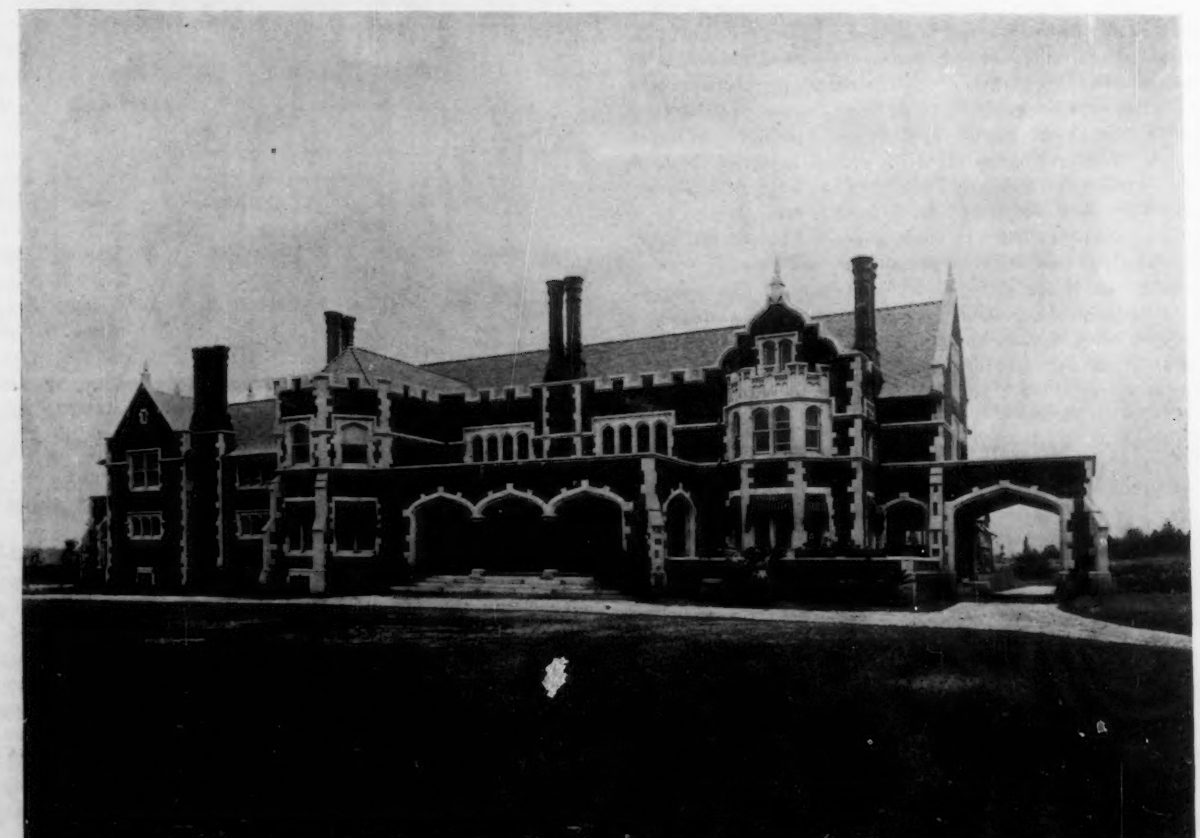
The work of Wilson Eyre is always interesting on account of his strong, artistic personality. His essays in the Georgian style have been quite as attractive as his well-known city fronts, with their delicate-pointed arches, and his shingle country houses, which conform so naturally to their surroundings. In their seemingly innate rightness of composition in motives and ornament his work bears comparison with the best of the English. He is represented at the T Square Club exhibition by a number of characteristic sketches in body color on a dark ground, which are unmistakably individual and distinguished.

In the department of ecclesiastical architecture, Maginnis, Walsh & Sullivan exhibit photographs of St. Patrick's Church, Whitinsville, Mass., a brick church with campanile after the Italian Gothic, altogether Roman Catholic in character, yet full of charm and artistic quality. This firm, though young in affairs, is already

BATTERSEA POLYTECHNIC, LONDON, ENGLAND.
E. W. Mountford, Architect.



HOUSE, ST. MARGARET'S, HARROW, ENGLAND.
Arnold Mitchell, Architect, London.

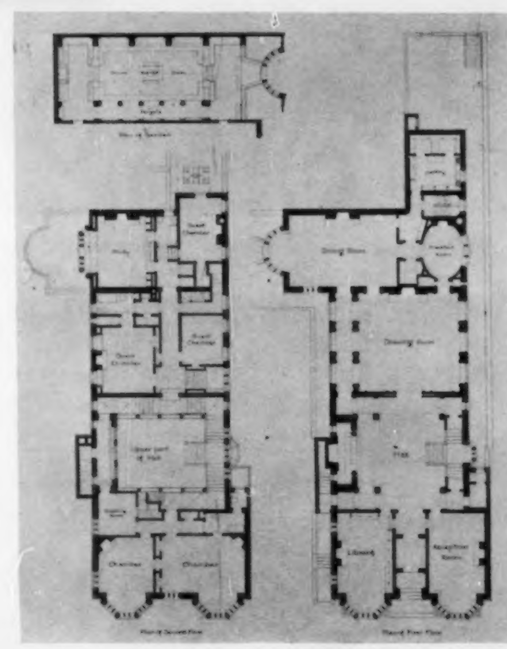


HOUSE AT WAYNE, PA.
W. L. Price, Architect.

looked upon as doing for the architecture of the Roman church, which has until lately accepted everything ugly and commonplace for its minor buildings, what Cram, Goodhue & Ferguson have done for the Anglican. A similar effort may be noted in the St. Augustine Roman Catholic Church at Pittsburgh, the work of Rutan & Russell, represented at the exhibition in a pen-drawing by J. T. Comes.

The searcher after truth in brickwork must have a glance about him, even if he is not permitted to enter at length into the interests of the stone mason and lumberman. The T Square Club exhibition is fortunate in the displays by many notable draftsmen. Joseph Pennell has sent a number of drawings from London. The work of Raffles Davison is amply presented. H. B. Pennell exhibits a collection of marvelous colored drawings, a part of the results of his tour abroad as Rotch Scholar. A half-dozen perspectives carry the distinction of a rendering by D. A. Gregg, whose pencil-work is the more welcome to us because it gives him the possibility of larger production. William Charles Hays, the second holder of the John Stewardson Memorial Traveling Fellowship, has a special exhibition of fifty of his envois, and Alfred M. Githens is distinguished by a number of masterly sketches in color, made in England last year. From the students' point of view, perhaps the most valuable feature of the exhibition is the entry by the University of California of twenty-two large carbon prints of the first eleven premiated drawings in the recent international competition won by M. Bénard. These, unfortunately, came too late for the catalogue.

The catalogue of the T Square Club exhibition is food for speculation as to the future of the exhibition catalogue if it is pushed to its logical conclusion; for the rivalry between clubs and even between various administrations in the same club will make it some day impossible for the catalogue to surpass itself. The T Square Club, which by its energy in developing new ideas has been steadily in the lead of catalogue making, has again brought the final issue closer by the innovation of a stamped cloth binding and of the use of brown ink for decorative cuts. The avowed intention is to make its publication "acceptable as a permanent addition to the Architectural Library." It will certainly have the result of throwing an added responsibility on the committees of the future in the selection of their subjects, and in presenting them in an orderly and compact manner. The expressed intention of this catalogue is to furnish a manual of modern architecture of as much practical value as possible, by the introduction of details, working drawings, and photographs of executed work, and by the suppression of unstudied sketches of ancient remains and architectural *tours de force*.



HALL AND PLANS OF A HOUSE ON LOCUST STREET, PHILADELPHIA.
Frank Miles Day & Bro., Architects.

This is sound policy toward making the architectural exhibition a strong educational influence, a moving school of architecture, as it were. If it were then possible to achieve a method of classification for the exhibits, so difficult now in the manifold embarrassments of the hanging committee, and a system by which all the premiated drawings of recent competitions could be collected, with programs and explanations for comparative study, the architectural exhibition would begin to fulfil its possibilities; — and the possibilities opened by the organization of the Architectural League of America, with its scheme of a circuit for exhibits, and its determination for concerted effort, suggest how powerful a factor the exhibition can be made.

DOUBLE HOUSE, GERMANTOWN, PA.
David Knickerbocker Boyd, Lawrence Visscher Boyd, Associate Architects.

Economics of Cement Mortar.

BY IRA O. BAKER.
M. Am. Soc. of C. E., Professor of Civil Engineering, University of Illinois.

IT is proposed in this article to inquire primarily into the economics of cement mortar.

METHODS OF PROPORTIONING THE MORTAR.

In laboratory work the proportions of cement and sand are uniformly determined by weighing, but there is no uniform practise of measuring the proportions on the work. One of the three following methods is generally employed, but unfortunately it is not usually stated which is used.

1. *By Weight.* The ingredients are weighed, or at least the weight of a unit of volume of the sand and of the cement is determined, and the relative quantities are fixed accordingly, the actual proportioning being done by volumes. This is the most accurate, but least common, method; and it would be somewhat inconvenient in practise, and would probably add a little to the cost of the work.

2. *Packed Cement and Loose Sand.* A commercial barrel of cement is mixed with one or more barrels of loose sand, *i. e.*, the proportioning is done by mixing one volume of *packed* cement with one or more volumes of loose sand. This method is frequently used. As far as the cement is concerned, it is as accurate as the first, since the weight and volume of a barrel of cement may readily be known when only whole barrels are used, as is usually the case. Even though the cement is received in bags, the barrel of packed cement is still a convenient unit, for an integral number of bags, usually three or four, are equal in weight to a barrel. As far as the sand is concerned, this method is not as accurate as the first. The weight of the sand is affected by the amount of moisture present, but a small amount of water affects the volume in a greater proportion than the weight. For example, the addition of 2 per cent. of water (by weight) thoroughly mixed with any sand increases the volume of the sand nearly 20 per cent. Therefore, if the mortar is proportioned by volumes, damp sand will give a richer mortar than dry sand. The effect of moisture on the volume is greater the finer the sand, and decreases as the amount of moisture increases. Measuring the sand by volumes is inaccurate, owing to the packing of the sand.

Except for the inaccuracies in measuring the sand, this method gives practically the same result for Portland as the first method, since ordinarily a unit of volume of packed cement and of sand, weighs substantially the same, viz., 100 lbs. per cubic foot. Since natural cement when packed in barrels usually weighs about 75 lbs. per cubic foot, a mortar of one part natural cement to one part sand, by weight, is equivalent to one and one third parts cement to one part sand, by volumes, of packed cement and loose sand.

3. *Loose Cement and Loose Sand.* A volume of *loose* cement is mixed with one or more volumes of loose sand. The actual proportioning is usually done by emptying a bag or fractional part of a barrel of cement into a wheelbarrow, and filling one or more wheelbarrows equally full of sand. As far as the sand is concerned, this method is as inaccurate as the second, and is also subject to great variations owing to differences in specific gravity, fineness, and packing of the cement. Even though inaccurate, it is very frequently employed. It is the most convenient method when the cement is shipped in bulk, which is only rarely.

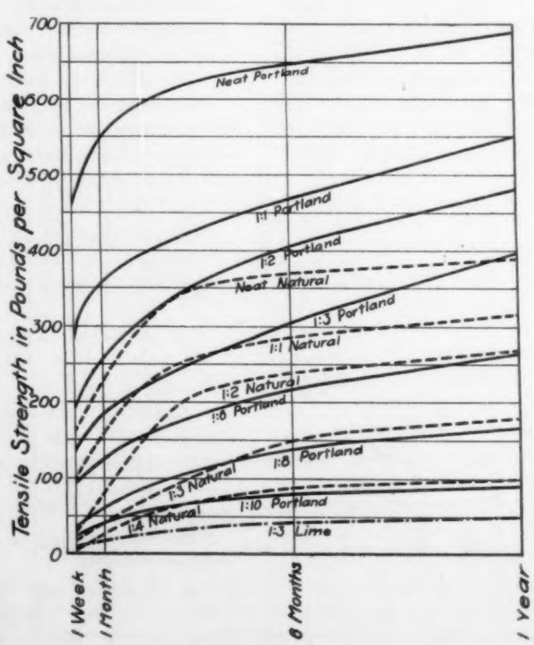


FIG. 1. DIAGRAM SHOWING THE EFFECT OF TIME ON THE STRENGTH OF MORTARS.

Occasionally the actual proportioning is done by throwing into the mortar box one shovelful of cement to one or more shovelfuls of sand. This is very crude, and should never be permitted.

Since a commercial barrel of Portland will make 1.1 to 1.4 barrels if measured loose, a mortar composed of 1 part Portland cement to 1 part sand, by weight, is equivalent to 0.7 to 0.8 parts of cement to 1 part of sand, by volumes, of loose cement and loose sand; and a mortar composed of 1 part natural cement to 1 part sand, by weight, is equivalent to 0.50 to 0.75 parts cement to 1 part of sand, by volumes, of loose cement and loose sand.

TABLE I.

CEMENT AND SAND REQUIRED FOR 1 CU. YD. OF MORTAR.

Parts sand to one part cement.	Mortar proportioned by weight.					Mortar proportioned by volumes of *packed* cement and loose sand.					Mortar proportioned by volumes of *loose* cement and loose sand.				
	Portland.		Natural.			Portland.		Natural.			Portland.		Natural.		
	Cement. bbl.	Sand. cu. yd.	Western. bbl.	Eastern. bbl.	Sand. cu. yd.	Cement. bbl.	Sand. cu. yd.	Western. bbl.	Eastern. bbl.	Sand. cu. yd.	Cement. bbl.	Sand. cu. yd.	Western. bbl.	Eastern. bbl.	Sand. cu. yd.
0	7.40	0.00	8.40	7.42	0.00	7.40	0.00	8.40	7.42	0.00	7.40	0.00	8.40	6.81	0.00
1	4.05	0.57	5.23	4.62	0.51	4.05	0.57	4.87	4.29	0.58	3.87	0.63	4.66	4.11	0.60
2	2.80	0.78	3.65	3.22	0.72	2.80	0.78	3.24	2.85	0.76	2.42	0.81	2.97	2.61	0.78
3	2.00	0.85	2.70	2.38	0.80	2.00	0.85	2.38	2.10	0.81	1.73	0.88	2.12	1.87	0.84
4	1.60	0.89	2.17	1.91	0.84	1.60	0.89	1.80	1.59	0.86	1.35	0.91	1.64	1.45	0.87
5	1.30	0.91	1.74	1.54	0.86	1.30	0.91	1.48	1.31	0.88	1.10	0.93	1.22	1.07	0.89
6	1.10	0.93	1.48	1.31	0.88	1.10	0.93	1.38	1.21	0.89	1.00	0.94	1.17	1.02	0.90

INGREDIENTS FOR A YARD OF MORTAR.

Table I. shows the approximate quantities of cement and sand required for a cubic yard of mortar by the three methods of proportioning described above. The table is based upon actual tests made by mixing 3½ cu. ft. of the several mortars[1]; but at best such data can be only approximate, since so much depends upon specific gravity, fineness, etc., of the cement, upon the fineness, humidity, sharpness, compactness, etc., of the sand, and upon the amount of water used in mixing.

The volume of the resulting mortar is always less than the sum of the volumes of the cement and sand, or of the paste and sand, because part of the paste enters the voids of the sand; but the volume of the mortar is always greater than the sum of the volumes of the paste and the solids in the sand, because of imperfect mixing, and also because the paste coats the grains of sand and thereby increases their size and consequently the volume of the interstices between them. This increase in volume varies with the dampness and compactness of the mortar. For example, the volume of a rather dry mortar with paste just equal to the voids, when compacted enough to exclude great voids, was 126 per cent. of the sum of the volumes of the paste and solids of the sand; and the same mortar when rammed had a volume of 102 to 104 per cent. If the paste is more than equal to the voids

[1] By L. C. Sabin, Assistant U. S. Engineer, in connection with the construction of the Poe Lock of the St. Mary's Falls Canal. See Annual Report of Chief of Engineers, U. S. A., 1894, p. 2326.

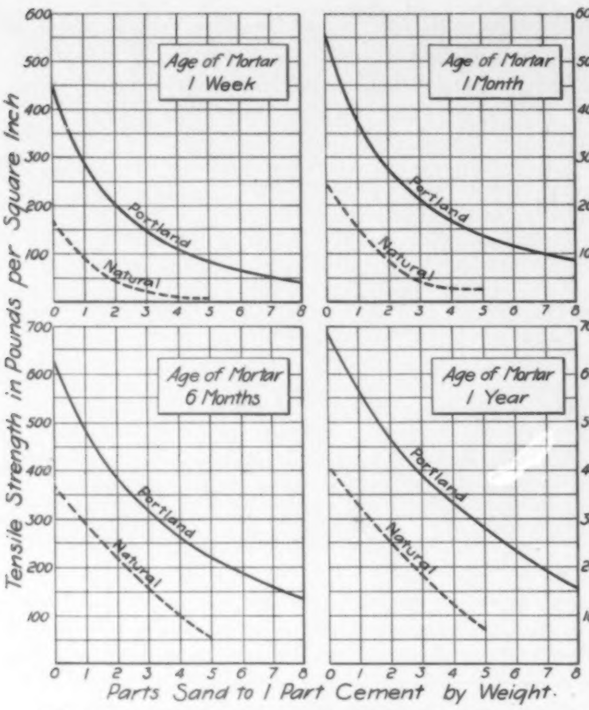


FIG. 2. DIAGRAM SHOWING THE RELATIVE STRENGTH OF CEMENT MORTAR.

the per cent. of increase is less, and if the paste is not equal to the voids the per cent. is more.

TENSILE STRENGTH.

Fig. 1 shows the effect of time upon the strength of various mortars. The diagram represents the average results of a great number of experiments made in connection with actual practise. Results which were uniformly extremely high or low as compared with other experiments were excluded on the assumption that the difference was due to the method of molding and testing. Since the individual values plotted were themselves means, there were no very erratic results, and consequently the lines are quite reliable. There were fewer experiments for the larger proportions of sand to cement; hence the curves are less accurate the larger the proportion of sand.

The line for strength of lime mortar probably represents the maximum value that can be obtained by exposing the mortar freely to the air in small briquettes. This line is not well determined.

Unusually hard burned Portland cement when tested neat will show a greater strength than that given in the diagrams. Very fine cement when mixed with sand will show greater strength than that given by Fig. 1. Again, the diagram shows neat cement, both Portland and natural, stronger than any proportion of sand; while frequently neat cement mortar is not as strong as a mortar composed of one part sand and one part cement, — particularly at the greater ages. However, notwithstanding these exceptions, it is believed that the results represent fair average practise. The proportions of sand to cement were determined by weight.

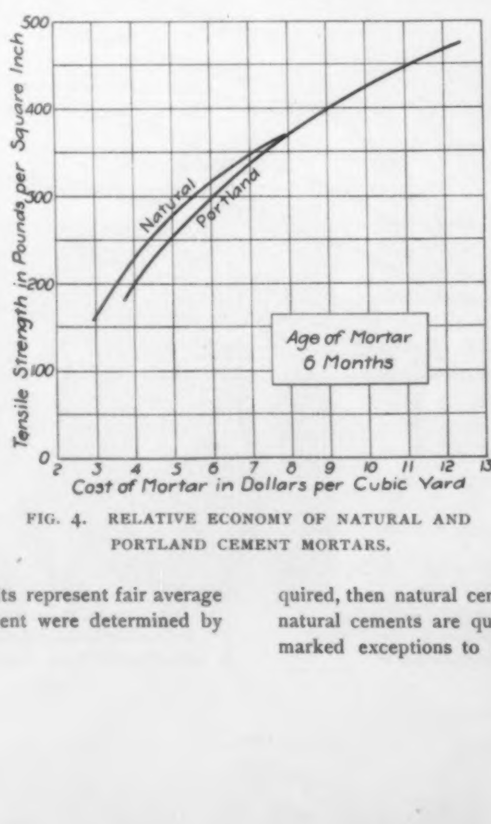


FIG. 4. RELATIVE ECONOMY OF NATURAL AND PORTLAND CEMENT MORTARS.

The results in Fig. 1 are tabulated in another form in Fig. 2 to show the effect of varying the proportions of the sand and cement, and also to show the relative strength of natural and Portland cement mortars at different ages. The curves of Fig. 2 are especially useful in discussing the question of the relative economy of Portland and natural cement. For example, assume that we desire to know the strength of a 1 to 2 natural cement mortar a year old, and also the proportions of a Portland cement mortar of equal strength. At the bottom of the lower right-hand diagram of Fig. 2 find the proportion of sand in the mortar, which in this case is 2; follow the corresponding line up until it intersects the natural line. The elevation of this intersection above the base, as read from the figure at the side of the diagram, is the strength of the specified mixture, which in this case is about 250 lbs. per square inch. The second part of the problem then is to determine the proportions of a Portland cement mortar which will have a strength of 250 lbs. per square inch. Find the 250 point on the scale at the side of the diagram, and imagine a horizontal line passing through this point and intersecting the "Portland" line; from this point of intersection draw a vertical line to the base of the diagram, and this point of intersection gives the required number of volumes of sand to one volume of cement, which in this case is 5.5. Therefore a 1 to 2 natural mortar a year old has a strength of 250 lbs. per square inch, and is then equivalent to a 1 to 5.5 Portland mortar.

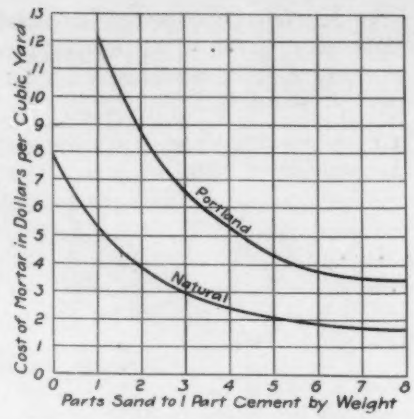


FIG. 3. DIAGRAM SHOWING THE RELATIVE COST OF CEMENT MORTAR.

COST OF MORTAR.

Knowing the price of the materials it is very easy, by the use of Table I., to compute the cost of the ingredients required for a cubic yard of mortar. The expense for labor is quite variable, depending upon the distance the material must be moved, the quantity mixed at a time, etc. As a rough approximation it may be assumed that a common laborer can mix 3 yds. per day, at a cost of say 50 cents per cubic yard. If the mixing is done by machinery, the cost may be as low as 25 cents per cubic yard. The cost of a cubic yard of mortar composed of 1 part Portland cement and 2 parts of sand, both by weight, is then about as follows: —

Cement .	2.80 bbls. @ $3.00 =	$8.40
Sand . .	0.78 cu. yds. @ .50 =	.39
Labor, handling material, and mixing. . . .	⅓ day @ 1.50 =	.50
		$9.29

NATURAL VS. PORTLAND CEMENT MORTAR.

It is sometimes a question whether Portland or natural cement should be used. If a quick-setting cement is required, then natural cement is to be preferred, since, as a rule, the natural cements are quicker setting, although there are many and marked exceptions to this rule. Other things being the same, a

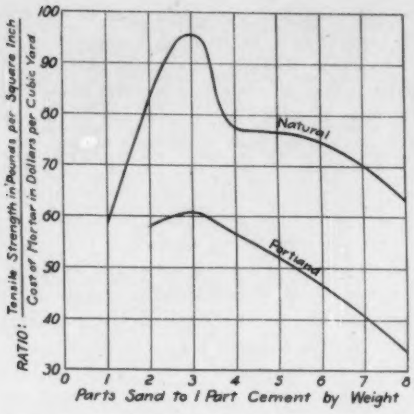


FIG. 5. ECONOMIC PROPORTIONS OF SAND.

slow-setting cement is preferable, since it is not so liable to set before reaching its place in the wall. This is an important item, since with a quick-setting cement any slight delay may necessitate the throwing away of a boxful of mortar on the removal of a stone to scrape out the partially set mortar.

Generally, however, this question should be decided upon economical grounds, which makes it a question of relative strength and relative prices. The tensile strength of natural and Portland cement mortars is shown in Fig. 2. The cost of mortar of various proportions of sand may be computed as in the preceding section; but as the cost of labor is uncertain and is substantially the same for both kinds of mortar, it is sufficient to deal with the cost of the materials only. Assuming Portland cement to cost $3 per barrel, natural $1 per barrel, and sand 50 cents per cubic yard, and using Table I., the cost of the materials in a cubic yard of mortar are as in Fig. 3.

By platting of Portland and natural cement mortar six months old, as given in Fig. 3, Fig. 4 is obtained, which shows the relation between the strength at six months and the cost of the mortar made of the two kinds of cement. Notice that for any tensile strength under about 370 lbs. per square inch, either natural or Portland cement may be used, but that the former is cheaper. In other words, Fig. 4 shows that if a strength of about 370 lbs. per square inch at six months is sufficient, natural cement is the cheaper. Nearly all carefully conducted tests of the strength of cement mortar six months old or over give a similar result, except that the above limit is usually between 300 and 350 lbs. A considerable change in prices does not materially alter the result, and hence the conclusion may be drawn that if a strength of 300 to 350 lbs. per square inch at six months is sufficient, *natural cement is more economical than Portland.* Mortar made of two brands of Portland or of natural cement will differ considerably in economic values, and hence to be of the highest value the above comparison should be made between the most economical Portland and the most economical natural cement, as determined by Table I. or II., page 76, of the April number of THE BRICKBUILDER.

Short-time tests do not warrant any general conclusion as to the relative economy of natural and Portland cements, since the strength at short times varies greatly with the activity of the cement. For example, the two upper diagrams of Fig. 2 when platted as in Fig. 4 show Portland to be the most economical, while other similar experiments show natural cement to be the more economical.

ECONOMIC PROPORTION OF SAND.

Fig. 5 shows the ratio of strength to cost for different proportions of sand, for both Portland and natural cements; in other words, Fig 5 shows the tensile strength in pounds per square inch for each dollar of the cost of a cubic yard. For example, if a natural cement mortar at six months has a tensile strength of 280 lbs. per square inch, and costs $2.95 per yard, the strength per dollar is $280 \div 2.95 = 94.9$ lbs. per square inch. In this way Fig. 5 was constructed, using the cost of mortar as given in Fig. 3, and the strength as determined by L. C. Sabin in connection with the construction of the Poe Lock on the St. Mary's Falls Canal. According to this diagram, the most economic mortar, either natural or Portland, consists of 3 parts sand to 1 part cement.

Fire-proofing.

FIRE-PROOF CONSTRUCTION OF BUILDINGS IN THE UNITED STATES.—*Concluded.*

BY R. W. GIBSON (NEW YORK).
(Read before the Royal Institute of British Architects.)

IT is interesting to note from actual observation, first, how a fire starts in such a building, and, secondly, how it spreads. There seem to be three principal sources of fire: one is the engine room and rubbish heap (if such be permitted) in the cellar, including, perhaps, that part of the electric wiring which is somewhat chaotic at the foot of the shaft. Next, the waste-paper basket, with the cigar ash or match thrown in; and, next, ignition from an adjoining or opposite building already on fire. The fire originating in the basement is perhaps the greatest danger, but it is usually soon detected, as men are on duty here at all times. It is frequently found fostered by an oil store, where lamps and oil cans are abundant. Such a thing should never be permitted at the foot of a stair or elevator shaft, nor should any large quantity of such combustible be admitted. The basement end of all elevator shafts and staircases should be completely closed off by tight iron doors, not latticed, but as nearly as possible air-tight doors and screens, which will serve to prevent fire drafts, and also to cut off engine-room smells from the upper parts of the building. This is done in the best buildings, and should be done in all. Its need is recognized in the building law of New York, which compels such treatment in apartment houses, and further orders that the floor over the cellar shall be fire-proof even in apartment buildings of non-fire-proof character in other stories.

The waste-paper basket and desk origin of fires is wonderfully rapid. Such a fire will make an office absolutely untenable within ten minutes from its commencement. Inasmuch as incombustible furniture can hardly be brought into general use at once, the most practicable present defense against such a fire is the fire hose in the building, always at the disposal of tenants or any person willing to use it. With such fire-proof construction as has been before described as perfect, such a fire can be safely left to burn out its own room if the door is closed and help is not forthcoming; this, in fact, has occurred in some cases in New York.

The manner in which fire spreads in a building has been very imperfectly described, probably very little understood, except by firemen, until these recent efforts to withstand it. It is easy to see how flame is communicated from one combustible mass to another, how it burns along a hand rail or up a wooden elevator guide, or through a door, admitting flame from one room to the next; but the passage of fire from one portion of a building to a remote part, apparently skipping intervening places, has been considered mysterious and unexplainable, yet is really very simple. A hot fire in a single room will generate a great amount of combustible smoke, which consists largely of gas; this rises by reason of its heat, and, escaping through fan lights and transoms, or open doors or windows into adjoining corridors, will travel, because of the wind draft, through the building a very considerable distance without being much diluted, and occasionally it will preserve such proportions of gas and air that a leaping flame in the original fire will ignite all the smoke practically at once in a kind of a low-power explosion. This may be on a very large scale in a very large building; a whole floor of a warehouse, for example, will become a mass of flame in an instant from a little fire in one corner, or it may be only a small volume of gas that is ignited in a long corridor of an office building; but, in either case, the fire, originally upon one side, may, after such an explosion, appear in many other places remote from the first. This is one of the risks which, in fire-proof building, should be guarded against by the use of fire-proof doors and wired glass, and it is to meet this danger that it is becoming recognized that corridors

and landings and stairs should not be of single unprotected construction, but should have some guard against flame, even though it be admitted that the full fire-proof flooring is not necessary.

An important effect of heat upon unprotected metal and, to a smaller extent, upon that which is protected, is the expansion, which may amount to a destructive quantity. Usually the protection herein recommended is sufficient to limit expansion to the extent necessary for riveted construction; but where ironwork, whether weight-carrying girders and trusses or merely external facings, is built upon and within masonwork walls and piers, and is unprotected from heat, it has sometimes pushed the masonwork out of plumb and thrown down portions before it actually failed of itself. It would, no doubt, be a good rule that all iron framing upon the fronts of buildings, such as bay windows and large mullions, should be protected with terra-cotta to the same extent customary in the interior.

In foundation work it is considered better in more recent practise to use heavy section rolled beams instead of railroad iron, and it is undoubtedly better to reduce the number of tiers of superimposed beams, and, if possible, construct each raft with one layer of beams and one collecting girder, which really replaces the upper tier of beams. This girder is made as deep as space permits, and partakes of the nature of an iron base stool, with offsets much elongated in one direction. Mr. Freitag's book (entitled "Architectural Engineering," published in New York, by John Wiley & Son) mentions certain forms of brick and concrete floors which are still used, and for which advantages are claimed. Other floors are constructed with light steel angle bars between the main floor beams carrying a light concrete covering, and finished underneath with a metal lath ceiling plastered in the usual way. Yet another floor uses metal ribs in segmental form between the main beams to secure the voussoirs of the arch, much like the old corrugated iron fire-proof floors. Some patents have been secured, and are being worked, claiming advantages in certain mixtures of concrete, as, for example, one which uses wood sawdust; but the practical public verdict with regard to all the systems of fire-proofing may be summarized in the statement that in an enormously large proportion, probably over 90 per cent., of all the work done some form of fire-proof terra-cotta is employed, and nearly every architect, engineer, or builder, who is unprejudiced by interest in one form or another, will admit that on the whole the terra-cotta is the most reliable and the most satisfactory.

Throughout these descriptions no mention has been made of porous terra-cotta. It should be explained that this form of material is preferred by many experts, as having better resistance to damage under either fire or water than the hard ringing terra-cotta. It is made by mixing the clay with sawdust, which in the burning is of course destroyed, leaving the earthen material in cellular form. Many of its advantages are apparent without explanation: it will hold nailings, and is therefore used for roofing slabs and blocks to support metal coverings which require holding by such methods. It is also used in brick and hard terra-cotta work for nailing blocks, just as wood blocks and plates were used in older brickwork. Porous terra-cotta nailing blocks enable the builder to entirely dispense with wooden blocks and nailings and bracketings, an improvement which is of vital importance. There seems to be no good argument against the use of porous terra-cotta throughout the flooring, partition, and furring work, except that in some localities it is rather more expensive, and although it may show slight superiority, yet the hard terra-cotta is so satisfactory that, where it is the cheaper form, it is quite justifiable to use it.

The New York City building law is so imperfect that its revision is now in hand; but its stipulations as to thicknesses of walls, and strains in various structures and materials, may be taken as typical of American practise of conservative tendency. Many cities have laws less exacting, and doubtless the new law for New York will tend in that direction. New York law stipulates 100 lbs. per superficial foot floor load for office buildings; a few years ago it demanded 150 lbs. Most of the expert opinion to-day would agree that 75 lbs. is sufficient, with the provision that any single foot of the floor should be capable of supporting a larger load, say 500 lbs., the 75 lbs. referring to distributed load over the whole surface; the reason for this distinction is that an office floor is never likely to be loaded throughout with more than 75 lbs. per foot, and beams and girders of this capacity are undoubtedly sufficiently strong, yet a concentrated load, such as a burglar-proof safe, may be placed occasionally upon a limited surface, and the structure should therefore be of such a nature that this point of strain may be equal to the emergency, assuming that the surrounding surface is not loaded. In other words, the weakest point of a beam or arch (viz., its center) should be capable of a center load of considerable magnitude, as well as being proportioned to the distributing load first stipulated. Difference of opinion and practise exists in regard to column loads. The New York law requires that the whole of the theoretical load, amounting in office buildings to about 180 lbs. (80 lbs. dead, and 100 lbs. live), should be accumulated floor by floor upon the columns, that is to say, the lowermost column should be capable of supporting every floor above it fully loaded. The Chicago architects, however, have calculated, and their views are gaining ground, that the assumed live load of superimposed stories may be decreased in calculating the strength of columns as the number of stories increases. The assumption is that the greater number of floors, or the quantity of floor space in question, the less likelihood of the maximum load in office buildings and dwellings being reached throughout simultaneously. The Chicago law has recognized this principle, although no particular rule as to its application seems to prevail. In some cases the uppermost story is calculated with the full live load upon the beams (of course the full dead load is included on all members), and about 86 per cent. of the live load upon the girders and columns; then the next story with the same loads upon the floors and girders, but only 80 per cent. of the additional load upon the columns; the next story with only 75 per cent. of the load upon the columns, and so on down; so that in the case of a building of fifteen or sixteen stories, the lower columns in the first, second, and third stories are calculated for live loads on those stories of only three or four pounds, or in some cases nothing at all; and the foundation is accurately adjusted for the dead loads with no provision whatever for live loads, it having been found that a foundation, sufficient when new, acquires considerably greater strength to support temporary loading after having properly settled and taken its bearings. This may be a somewhat daring theory, but it provides a column in the lower story which is sufficient for the full average load for the building, say about 25 lbs. per square foot of floor surface, and the material is placed in the most scientific as well as the most practical manner; but it is argued by many authorities, especially in New York, that municipal regulation of buildings is unable to completely control their uses after they are finished, and that although a building may be erected for offices or apartments, parts of it are likely to be converted to the use of light storage or light manufacture, or to other purposes, and a considerable margin should be provided to cover such contingencies. Some buildings have been designed with the live load calculated at 70 lbs. per foot on the beams, 50 lbs. per foot on the girders, 40 lbs. per foot on the columns, and nothing upon the footings, the dead load being, of course, included to its full amount, about 90 lbs. throughout.

The Onondaga County Savings Bank building, at Syracuse, N. Y., by the writer, was designed and calculated as follows: —

Load on all beams	= total dead load + 70 lbs. per ft. live load.
Load on all girders	= total dead load + 60 lbs. per ft. live load.
Load on columns of three upper stories	= total dead load + 60 lbs. per ft. live load.
Load on columns of remaining stories .	= total dead load + 40 lbs. per ft. live load.
Load on foundations	= total dead load + 20 lbs. per ft. live load.

There is no doubt that the New York building law will permit of a decreasing percentage of the floor load upon the columns of many-storied buildings, and possibly a decreasing but never vanishing proportion will be the basis of the rule: as, for example, a reduction by 5 per cent. at each story of the total live load brought

down from superimposed stories, the percentage being reckoned in each case upon the total, and not upon the original floor loads; and of course, as before stated, the full dead load being included on every member throughout.

Another reason for abundant provision of strength in fire-proof office building is the custom of building fire-proof partitions, counters, and heavy desks upon the floors without special regard to their positions over beams or girder. A floor is rented by a bank, for example, and is loaded with a marble counter and steel fittings weighing possibly over 300 lbs. per lineal foot, or perhaps a partition with a very narrow base. These things cannot be prevented, and therefore should be provided for; their place cannot be anticipated, so the only provision is a general stiffness of the floor, which, however, need not be carried to the columns, except as already averaged.

As to the load on foundations, practise varies very much. The enormous pier loads showing considerable inequalities require an exact adjustment of their superficial area to the load to be supported, or else the building will be racked and cracked by unequal settlements. In Chicago settlements of 4 ins. are not at all extraordinary; in New York 1 in. is quite frequent. If two piers are made with equal size base courses, and one is loaded with 500 tons and the other with 250 tons, the more heavily loaded pier will settle more proportionately than the lighter loaded one, and the building will be out of level, and will show cracks. This has actually occurred by reason of municipal regulations as well as because of too theoretical a view in calculations. Long since the days when it was recognized that the foundation must be proportioned to the load, buildings have been erected where one pier supported 520 tons of dead load, and another pier 500 theoretical tons, of which 200 were dead load and 300 live load, an arrangement which taught the lesson that a live load which was continuously absent would have no effect upon the building, and provision for it would be injurious. As a fact, such columns and piers have been found standing from 1 to 3 ins. higher than their calculated settlement. From this position arose a custom of disregarding the dead load, by the experience, before mentioned, that a foundation, after it reached a certain age, would bear temporarily and within limits increased loads without any further settlement. Many Chicago buildings are so calculated with their dead loads equally balanced, and with no provision at all for live loads, and in most cases it has worked well; but there is always the risk of a greater load being imposed, which would cause serious damage; in fact, it happened on one occasion that a warehouse had to be emptied most expeditiously, because the column foundations were sinking into the Chicago mud with dangerous speed.

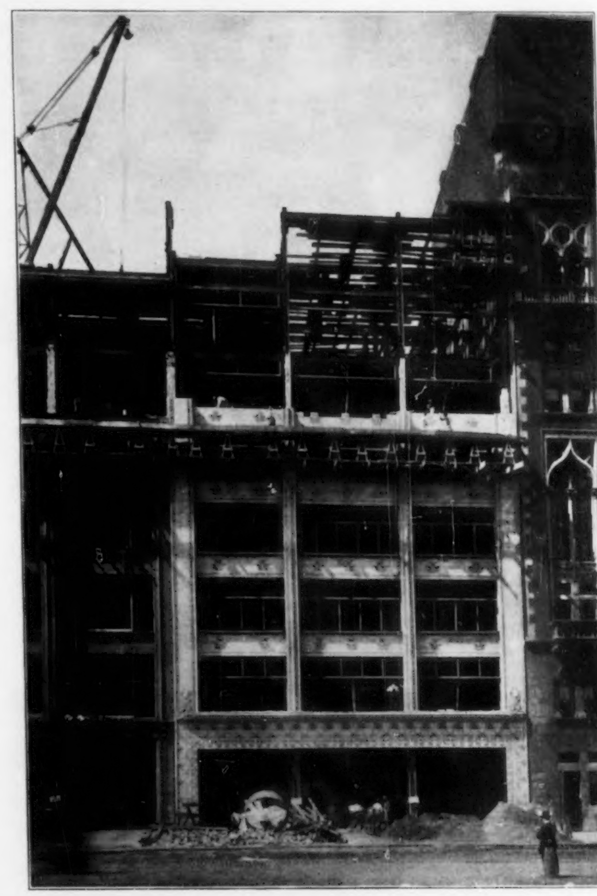
The better practise undoubtedly is to proportion the foundations to the true average load which they will have to bear, and which will be found to amount to 15 or 20 lbs. per superficial foot in offices and dwellings; sometimes something must be added to cover heavy decorations and finishings, such as marble wainscotings; but generally 20 lbs. will provide for this, and when added to the dead loads will not make the column foundations too large for their work. The character of the soil will, in some cases, permit without injury considerable variation in the load per foot upon the base course, but on all soft or compressible soils the problem is a very serious one when from ten to twenty fire-proof floors are built upon them. Superfluous strength in the columns is not injurious, it is simply uneconomical; but superfluous strength in the foundation base course is positively a danger to the building. The only safe practise, therefore, is that which arrives most correctly at the actual load to be supported, and proportions the work accordingly.

Much of the above comment relates to construction, as such, distinct from the fire-proofing; but the two are so intimately associated that they have been evolved one with and for the other. It is easy to see how the same principles of fire-proofing could be applied to construction of a different nature, and it is evident that the experience gained in regard to the fire-resisting qualities of certain materials has its scientific value quite apart from its application to any particular method of building.

Brick and Terra-Cotta Work in American and Foreign Cities, Manufacturers' Department, and Miscellany.

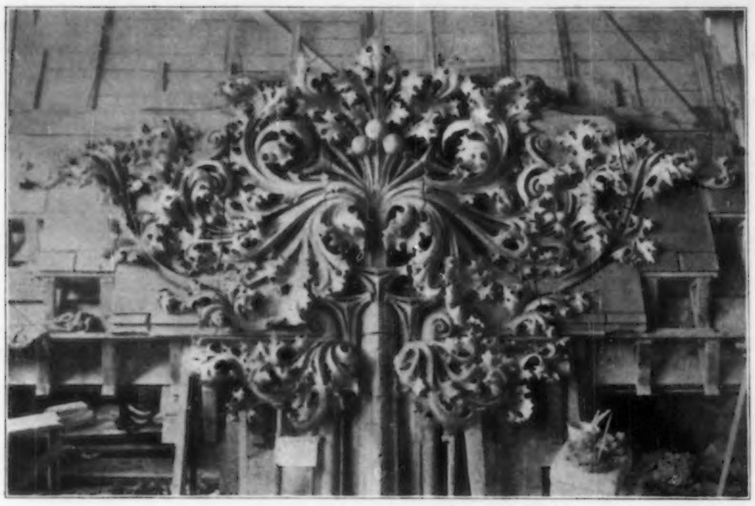
INTERESTING NEW STORE FRONTS AT CHICAGO.

THERE is now in course of construction on the west side of Michigan Avenue, facing the Grant Park, Chicago, a row of three wholesale stores belonging to Stanley R. McCormick. These are to be occupied by three of the leading wholesale millinery firms of that city. They are all built with steel skeleton construction, and embody the latest improvements in fire-proofing with semi-porous fire clay, this work being done by the Pioneer Fire-proof Construction Company. They are all planned and constructed by one firm of architects, but the front of the most northerly one is designed and built under the supervision of Louis H. Sullivan. The south



CONSTRUCTION AND ARCHITECTURAL TREATMENT OF A CHICAGO STORE FRONT.
Louis H. Sullivan, Architect.

store is six stories high, the middle one is seven stories high, and the northerly one is eight stories high, and adjoins the Chicago Athletic Club, designed by Henry Ives Cobb. The south and middle buildings have fronts of molded red brick. Mr. Sullivan's front is of gray terra-cotta, by the Northwestern Terra Company, the first story being faced with ornamental cast iron. The three stores are constructed as one, and can be thrown into one; but the party walls are built around the steel frame, first by covering the steel columns and girders with hollow semi-porous fire clay, and then enclosing the same construction with four inches of common brick, and filling the



DETAIL OF TERMINALS OF INTERMEDIATE PIERS, CHICAGO STORE FRONT.
Executed by the Northwestern Terra-Cotta Company.
Louis H. Sullivan, Architect.

panels between the columns and girders with 12 in. brick walls. This has lately become the approved method of constructing party walls in Chicago, when steel skeleton construction is used.

The front shown in the illustration is 62 ft. wide. In construction and method of architectural treatment it is a repetition of the system used in the Ayer Building, which was described and illustrated in THE BRICKBUILDER for February, 1899. The photograph was purposely taken before the construction had advanced sufficiently to prevent its being seen, though when completed this will be evident to any one who knows that the steel skeleton construction has become a recognized system of building; for it will be equally evident to any one of elementary knowledge that this front could be successfully built in no other way. It is, therefore, presented as one of the rational solutions of the modern building problem, when treated by an artist of the first ability. But there is more than this in it. It is an illustration of the relation of commercialism to art that is not often found, and demonstrates how art has its commercial value in a wholesale store front. These three buildings are erected expressly for the tenants who are to occupy them on long leases. They were all leased before they were commenced, and the rent paid is a uniform percentage on the capital invested in each. The firm of Gage Bros. & Co., who are to occupy the store shown in the illustration, offered to pay additional rent at the same percentage on the increased cost of employing Mr. Sullivan and erecting such a front as he should design. They did so because they thought it would benefit their business in an equal degree. They put an exact commercial value on Mr. Sullivan's art, otherwise he would not have been called in. The other two stores are different, as will be seen in part of one of them, but the construction is on the same principle. All of them are evolutions of rational commercial architecture from steel and clay. The steelwork of the fronts is covered with fire-proof material first, and the finished front covers this, following the same constructive lines.

The illustration, taken from a photograph of part of the terra-cotta details, shows how the two intermediate piers will blossom forth when they pass above the last point of support below the cornice. It was taken from the dried but not burned clay, in the shop. The pier moldings seem to rejoice that their work is done. Any one who is fond of endives will realize whence the decorative motive came. The rest of the detail is too delicate to be seen in the main illustration. The whole as finished will be seen in a later number of THE BRICKBUILDER.

SPANDREL, CHERRY STREET ENTRANCE, MEDICO CHIRURGICAL HOSPITAL, PHILA., PA.
Executed by the Conkling-Armstrong Terra-Cotta Company.
Herman Miller, Architect.

PHILADELPHIA. — The monthly meeting of the T Square Club was held on Wednesday evening, December 6, at which drawings were submitted for the third competition in the series of the traveling fellowship program. The subject was "The Elevations of a Semi-Suburban Residence to be Characteristically Philadelphian in Treatment," and the designs were original and especially interesting as solutions of the problem of local expression in architecture. By judgment of the club the first place was awarded to Andrew T. Sauer, the second to I. Edgar Hill, and the third to W. P. Trout.

CARTOUCHE ON XAVIER PAROCHIAL SCHOOL, NEW YORK CITY.
Executed by the New York Architectural Terra-Cotta Company.
Little & O'Connor, Architects.

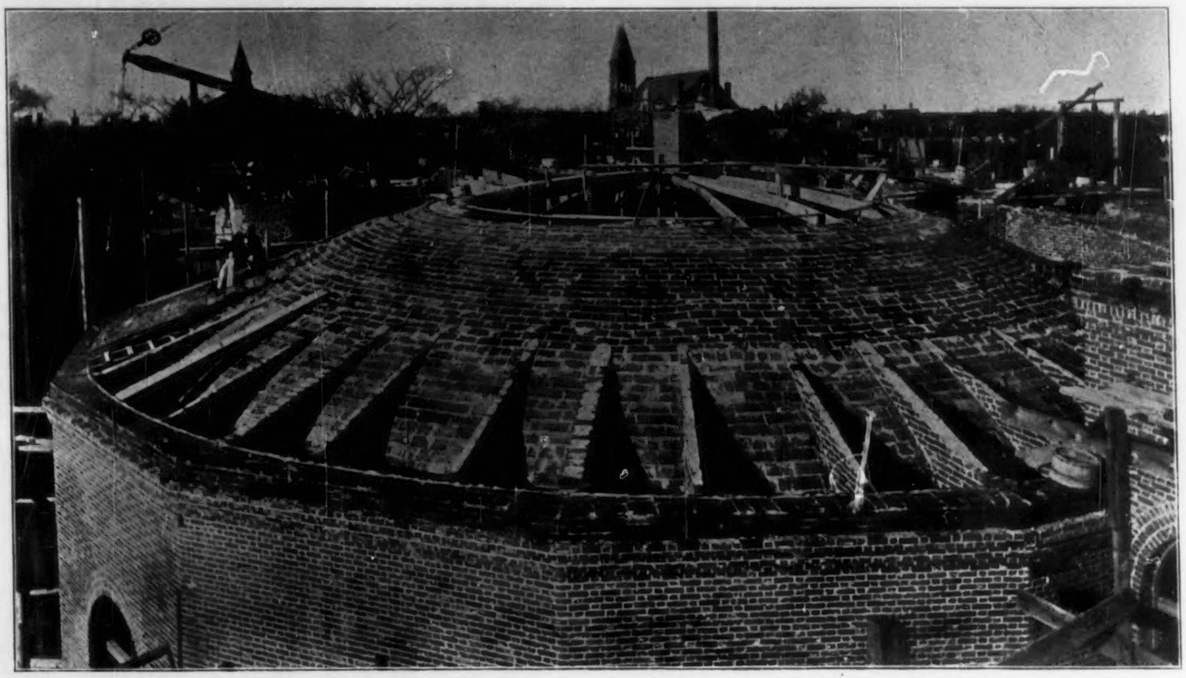
On Monday evening, December 4, after the meeting of the jury of selection of the exhibition, the visiting members, Mr. J. Randolph Coolidge, of Boston, Mr. Julius F. Harder, of New York, and Mr. John T. Comes, president of the Architectural Club of Pittsburgh, were the guests of the T Square Club, at a dinner given in the club house, at which Mr. Herbert G. Ripley, of Boston, was also present. The occasion was one to be remembered with pleasure by the club.

The annual architectural exhibition will be held at the Art Club from Dec. 17, 1899, to Jan. 6, 1900; the opening reception taking place Saturday evening, December 16.

A special meeting was held on Saturday, Nov. 18, 1899, to commemorate the sudden death of Adolfo C. Muñoz, a member, and at one time secretary of the club, and a memorial adopted as follows: —

"*Whereas*, God in His wisdom has taken from us our respected and beloved associate, Adolfo C. Moñoz. Therefore, be it

"*Resolved*, That the members of the T Square Club express to his family their heartfelt sympathy in this affliction. We deeply mourn his loss as an officer of the club, as one of its most active supporters, and as a man of marked ability in his profession. His steady adherence to the highest ideals and his fidelity of purpose stand as a permanent inspiration to us and for him as a noble memorial."

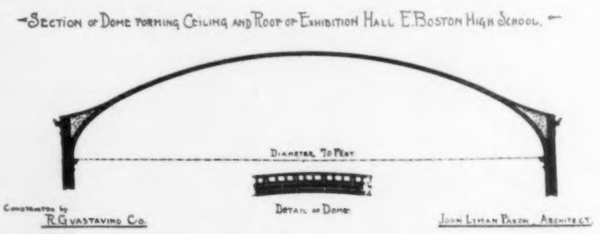


DOME OF HIGH SCHOOL, EAST BOSTON, MASS., 70 FEET IN DIAMETER.
Constructed by R. Guastavino Company.
John Lyman Faxon, Architect.

PILASTER AND CAP, HOTEL FOR WHITE ESTATE, NEW YORK CITY.
Executed by the Atlantic Terra-Cotta Company.
Barney & Chapman, Architects.

ST. LOUIS.—There seems to be some diversity of opinion as to whether the advance in building materials, with indications of further increase, together with the promised demands of labor for the coming year, may not prevent any marked improvement in building. The advance in many instances has been remarkable, considering the fact that there has been no unusual activity. Laths, for instance, have advanced from $2.00 per thousand to $7.00, while the increase in the cost of many other materials will average about 50 per cent. These prices may not be more, if as much as they were in 1893, but the sudden change is what startles the investor.

It is quite likely that the price of coal will enter very largely into the question of location of large manufacturing enterprises at St. Louis in the future, and it is causing no little discussion in building and manufacturing circles. The cost of delivering coal from the east side of the river is more than the original cost of the coal. Good slack coal costs about $1.00 per ton in East St. Louis, while it costs $2.80 on this side for the same coal. This has caused some of our largest manufacturing concerns to move to the Illinois side, in one instance resulting in the construction of buildings at a cost of a half million dollars and the building up of an entire town. A number of suggestions to overcome the trouble have been offered, among which



TERRA-COTTA PANEL, APARTMENT HOUSE, NEW YORK CITY.
Executed by the New Jersey Terra-Cotta Company.
John Hauser, Architect.

OFFICE FOR DR. H. N. SPENCER, ST. LOUIS, MO.
J. L. Wees, Architect.

are the building of a tunnel under the river, or the construction of a large power plant on the East St. Louis side.

The St. Louis Cold Storage and Refrigerating Company are putting up a seven-story plant on the west side of Lewis Street, near Dickson Street, at a cost of $175,000. The building will be 200 by 130 ft., and occupies the former site of the Belcher sugar refinery, which was demolished to make way for it. The refinery plant originally cost about $1,000,000, and was closed by the trust.

St. Louis now boasts of an up-to-date music hall in the Odeon, which has just been finished. The building is located on Grand Avenue, and is six stories high. The stage has a seating capacity of eight hundred persons, with a proscenium of 71 ft. The acoustics seem to be very satisfactory. The building is of stone, brick, and terra-cotta, and cost $350,000. Mr. W. Albert Swasey was the architect.

Eames & Young have completed the factory building on North Broadway, for the Monarch Rubber Company, at a cost of $40,000. Barnett, Haynes & Barnett have commenced the new building on Florissant and Emerson Avenues, for St. Mary's Orphans' Asylum. It is to be 265 by 140 ft., and four stories high.

Architect J. L. Wees is putting up an eight-story building, 66 by 105 ft., on Eighth Street and Lucas Avenue. The building will be of the mill construction or slow combustion type, and will be an acceptable addition to the large group of similar buildings that have been built in that vicinity on Washington Avenue during the last few years. The Walker estate is also putting up a six-story warehouse on Washington Avenue, between Eighteenth and Nineteenth Streets.

PANEL IN PEDIMENT OVER WINDOW, APARTMENT HOUSE, NEW YORK CITY.
Executed by the Atlantic Terra-Cotta Company.
George Keister, Architect.

CAPITAL FOR RESIDENCE AT ST. LOUIS.
Executed in terra-cotta by the Evens & Howard Company.

CURRENT ITEMS OF INTEREST.

WILLIAM HOMES & CO. have made arrangements with the Penn Buff Brick and Tile Company to handle their "Blue Ridge" enameled bricks in the Boston market.

CHAMBERS BROTHERS COMPANY have been awarded the contract for the extensive machinery improvements to be made by the Baltimore Brick Company in their various brick plants.

THE GRUEBY FAIENCE COMPANY have recently opened a new office at 2A Park Street, Boston, Mass., where samples of the Grueby tile and their other clay materials may be seen at any time, and estimates on same obtained.

UNION CLUB, ST. LOUIS, MO.
Grable, Weber & Groves, Architects.

WALDO BROTHERS have closed a large contract to furnish the Atlas Portland and Hoffman Cements for new work by the Massachusetts Metropolitan Sewerage Commission, Beckwith & Quackenbush, contractors.

THE MOSAIC TILE COMPANY have closed the contract for floors in the sanctuary of St. Benedict's Cathedral, Savannah, Ga. They also report that they are adding new machinery to their plant and building new warehouses.

W. L. MILLER, contractor, Boston, has placed his order with Waldo Brothers for a large amount of Atlas Portland Cement, to be used in the extension of Dorchester Avenue, and also in the Park Department work on Charlesgate, Boston.

BURGY & MCNEILL have just closed the contract to supply the brick for twenty-four brick houses to be erected in the East End district of Pittsburgh. The contract calls for 450,000 Roman brick of various shades, all of which are to be manufactured by the Ohio Mining and Manufacturing Company, Shawnee, Ohio.

WALDO BROTHERS have orders to furnish the gray Raritan brick for the Wheatland houses, Bay State Road, and for the Pemberton Building, Pemberton Square, Boston. They have also sold for the Perth Amboy Terra-Cotta the light-colored brick to be used in the front of the addition to the Telephone Building, corner Milk and Oliver Streets, Boston.

RESIDENCE AT LONGWOOD, MASS.
Chamberlin & Whidden, Architects.

PANEL IN BALUSTRADE COURSE, HOTEL FOR WHITE ESTATE, NEW YORK CITY.
Executed by the Atlantic Terra-Cotta Company.
Barney & Chapman, Architects.

TERRA-COTTA SHIELD.
Executed for the Main Building, University of Illinois, Urbana, Ill., by Evens & Howard Company.
J. C. Lewellen, Architect.

FISKE & Co., of Boston, have closed contract for roofing the residence of A. B. Turner, Newton, Mass., Willard T. Sears, architect, with red Ludowici roofing tiles of the Spanish roll pattern. These tiles are of an interlocking type, which secures absolute tightness against leakage. They are secured to the roof by means of wires in such a way that danger from breakage is entirely avoided. No cement is used in the setting. It is now generally recognized that the artistic effect that is produced by the use of roofing tile as a covering for buildings cannot be obtained in any other materials.

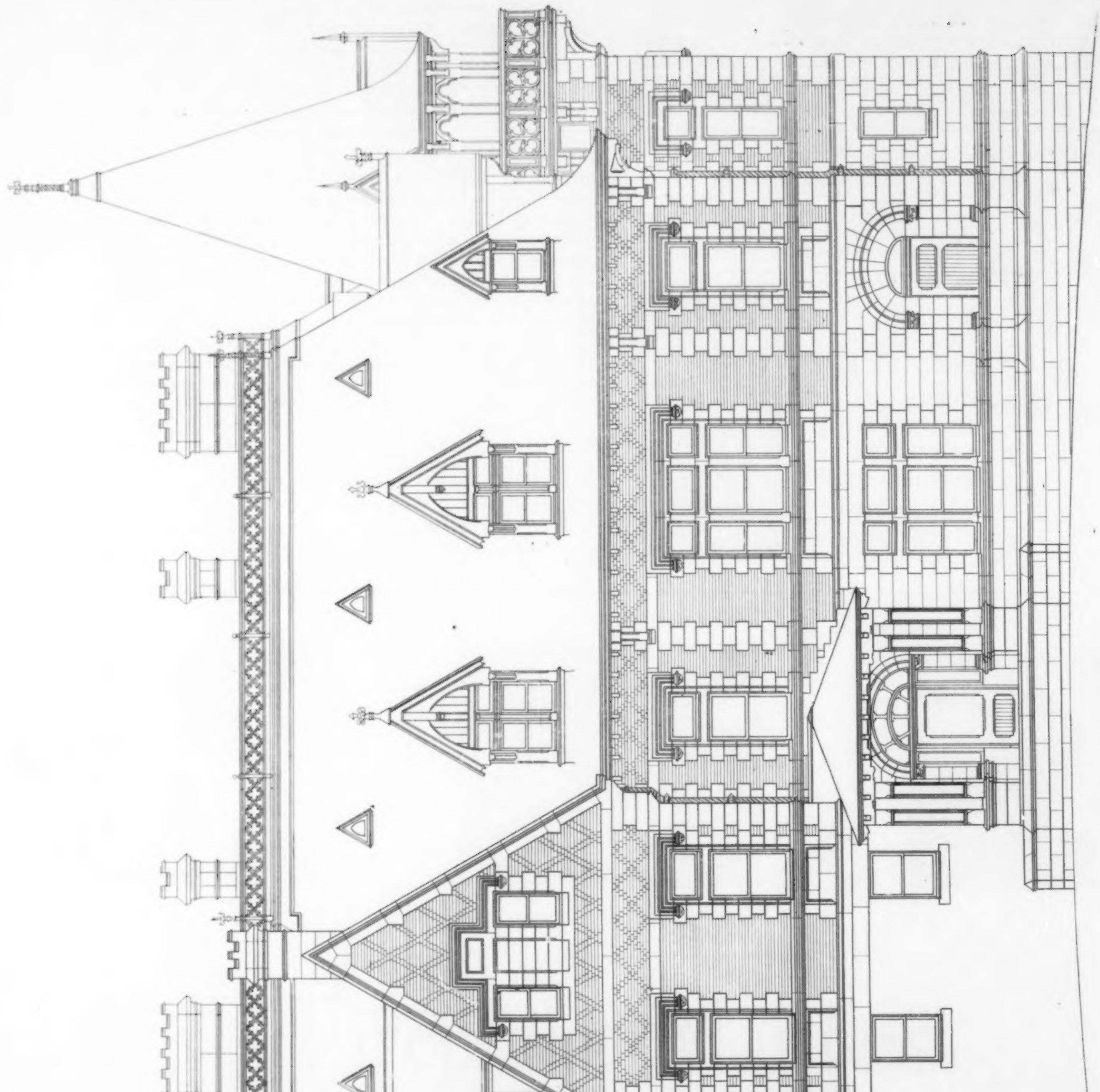
THE BOLLES REVOLVING SASH COMPANY have secured contracts to furnish the "Queen" overhead pulley in the following buildings: Public school, Dorchester, Mass., A. W. Gould, architect; Star Building, Washington, D. C.; emigrant station, New York City, Boring & Tilton, architects; Broadway Chambers, New York City, Cass Gilbert, architect; Leggett Building, Brooklyn, N. Y., Geo. W. Morse, architect; New York Hospital, New York City, Cady, Berg & See, architects; Cheseborough Building, New York City, Clinton & Russell, architects; Williamson Building, Cleveland, Ohio, Geo. B. Post, architect.

CARTOUCHE PANEL, PADDOCK & HODGE BUILDING, TOLEDO, OHIO.
Executed by the Indianapolis Terra-Cotta Company.
George S. Mills, Architect.

THE CELADON TERRA-COTTA COMPANY, LTD., are furnishing

the roofing tiles on the following building operations: Library at Torrington, Conn., Stephenson & Greene, architects; houses at 1 and 2 Beaconsfield Terrace, Brookline, Samuel D. Butterworth, Jr., architect; stable for J. B. Haggin, Lexington, Ky., Elzner & Anderson, architects; residence for Mrs. Pyne, Princeton, N. J., Clinton & Russell, architects; public school, Glen Ridge, N. J., Boring & Tilton, architects; chapel and convent buildings, Trinity College, Washington D. C., E. F. Durang, architect.

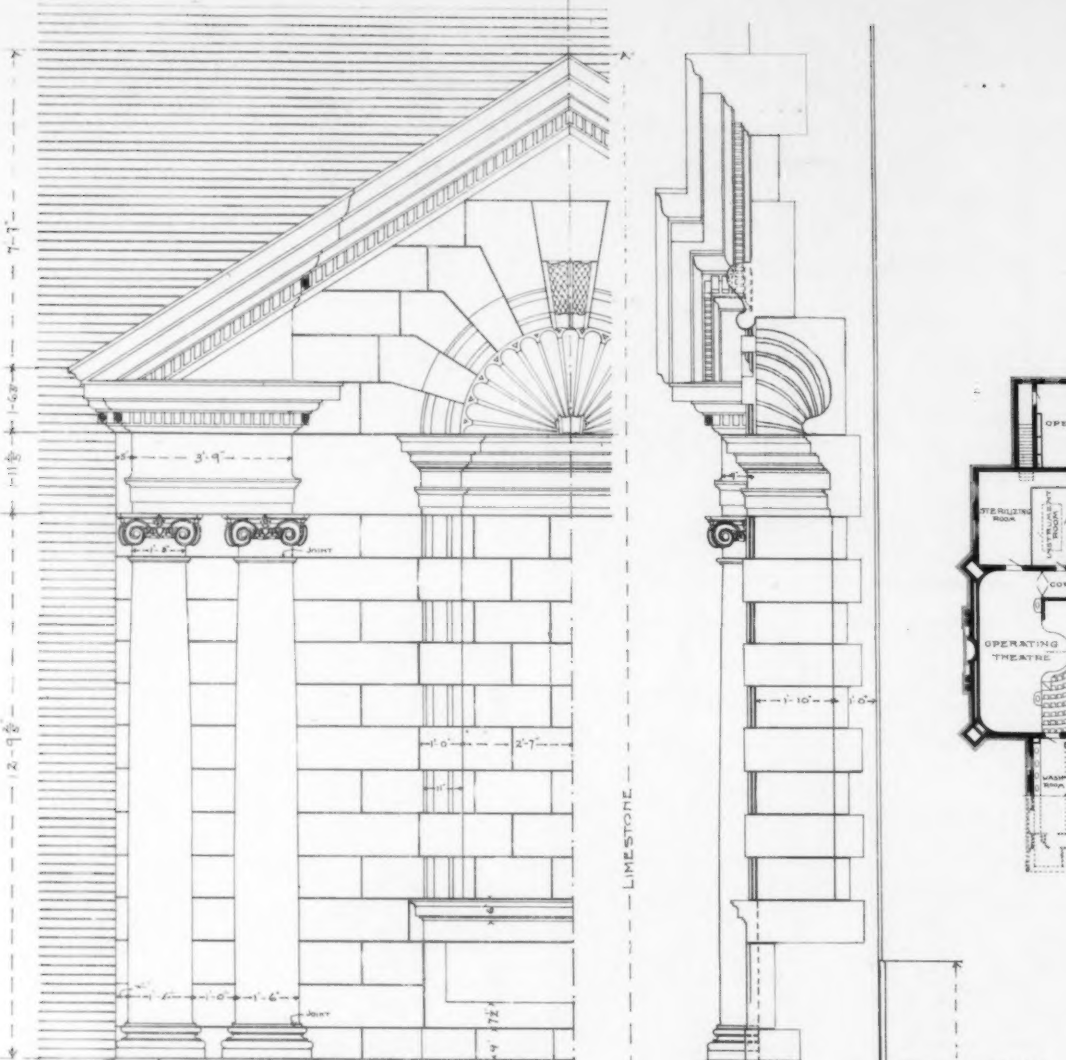
MR. WILLIAM HOMES, so long and favorably known in connection with the firm of Fiske, Homes & Co., Boston, managers for the Boston Fire Brick Company, has recently established himself at 186 Devonshire Street, Brewer Building, under the style of Wm. Homes & Co. After serving an apprenticeship of twenty-two years in the old house, thirteen of which he was in the management, he now starts his own firm with the best wishes of his many friends and business acquaintances. He is representing some of the best houses in this country, and makes a specialty of front and fire bricks, and also general builders' supplies. Among these companies may be mentioned the following: Columbus Face Brick Company (celebrated "Ironclay" bricks), Columbus, Ohio; B. Kreischer & Son, New York; Columbus Brick and Terra-Cotta Company, Columbus, Ohio; Ridgway Press Brick Company, Ridgway, Pa.; Presbrey Stove Lining Company, Taunton, Mass.; Brooklyn Retort and Fire Brick Company, Brooklyn, N. Y. Mr. Harry Damon, formerly employed with the old house, has been engaged as salesman, and his fifteen odd years of experience under Mr. Homes's guidance have certainly made him a fitting representative in the new venture.



North Elevation.

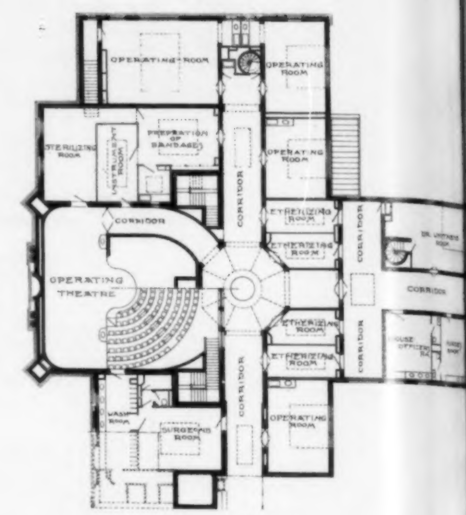
HOUSE AT TUXEDO PARK, NEW YORK.

ADAMS & WARREN, Architects.



· HALF · ELEVATION ·

· SECTION ·



PLAN.

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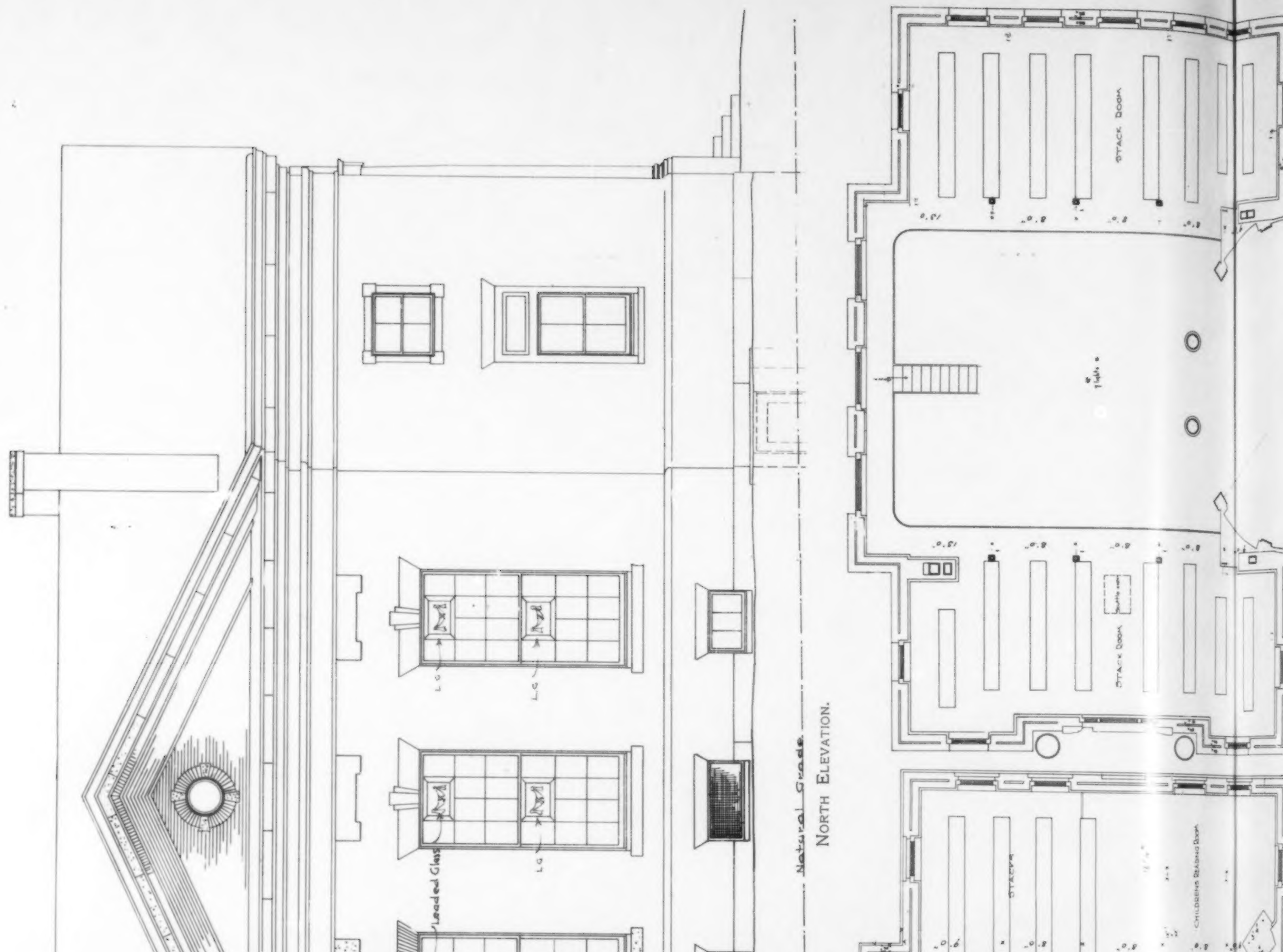
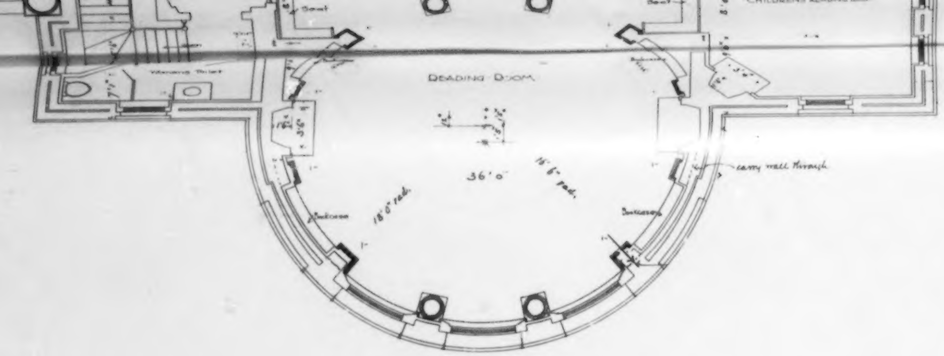
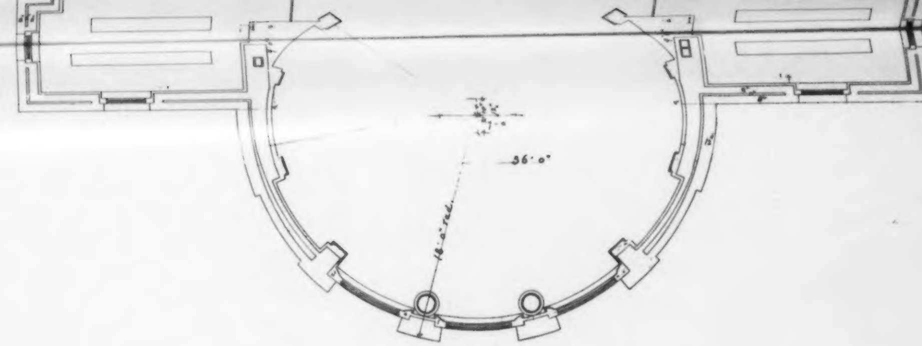
NG. S. GENERAL HOSPITAL, BOSTON.
GHT & EN, ARCHITECTS.



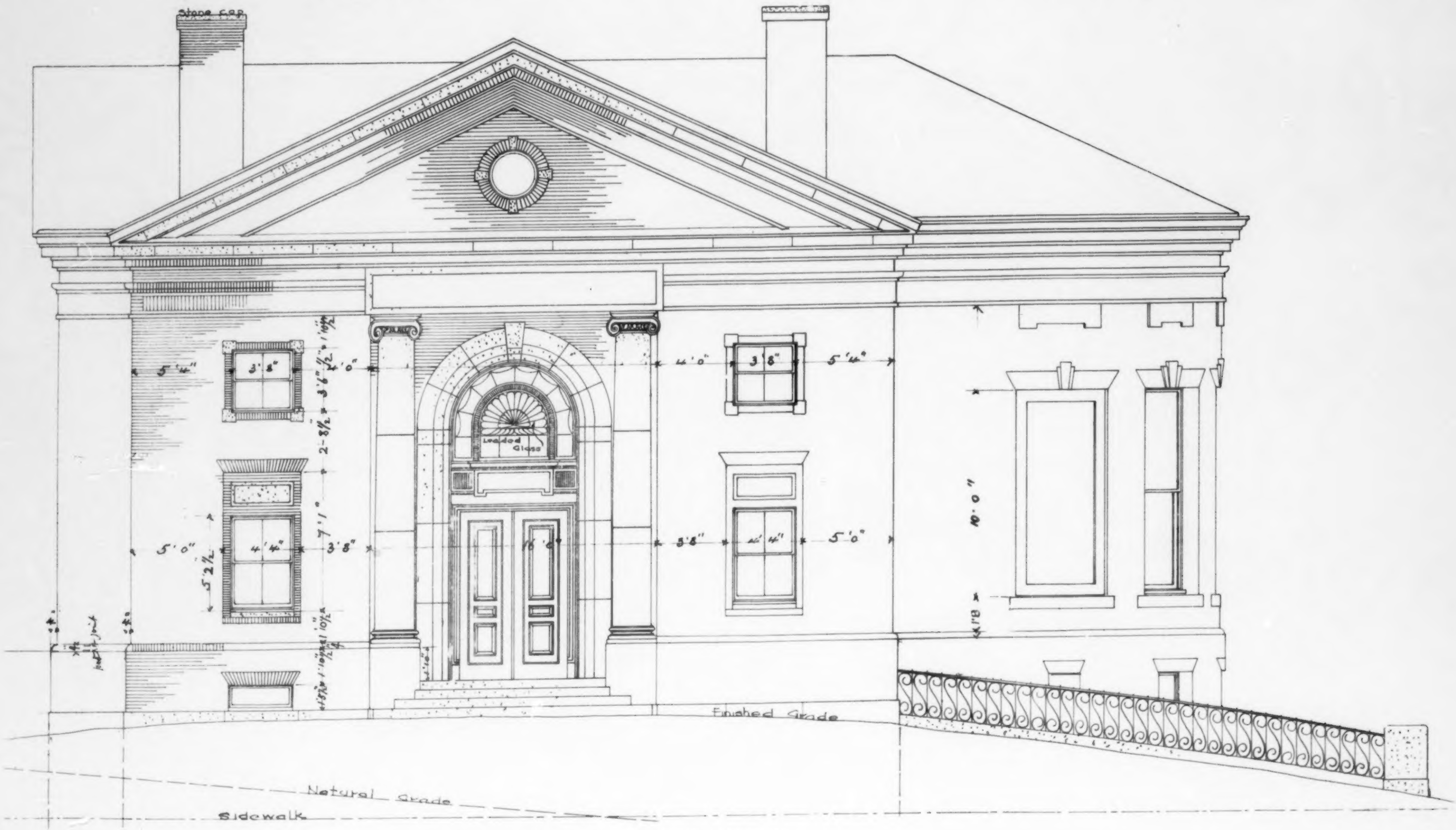
NORTH ELEVATION.



First Floor Plan.



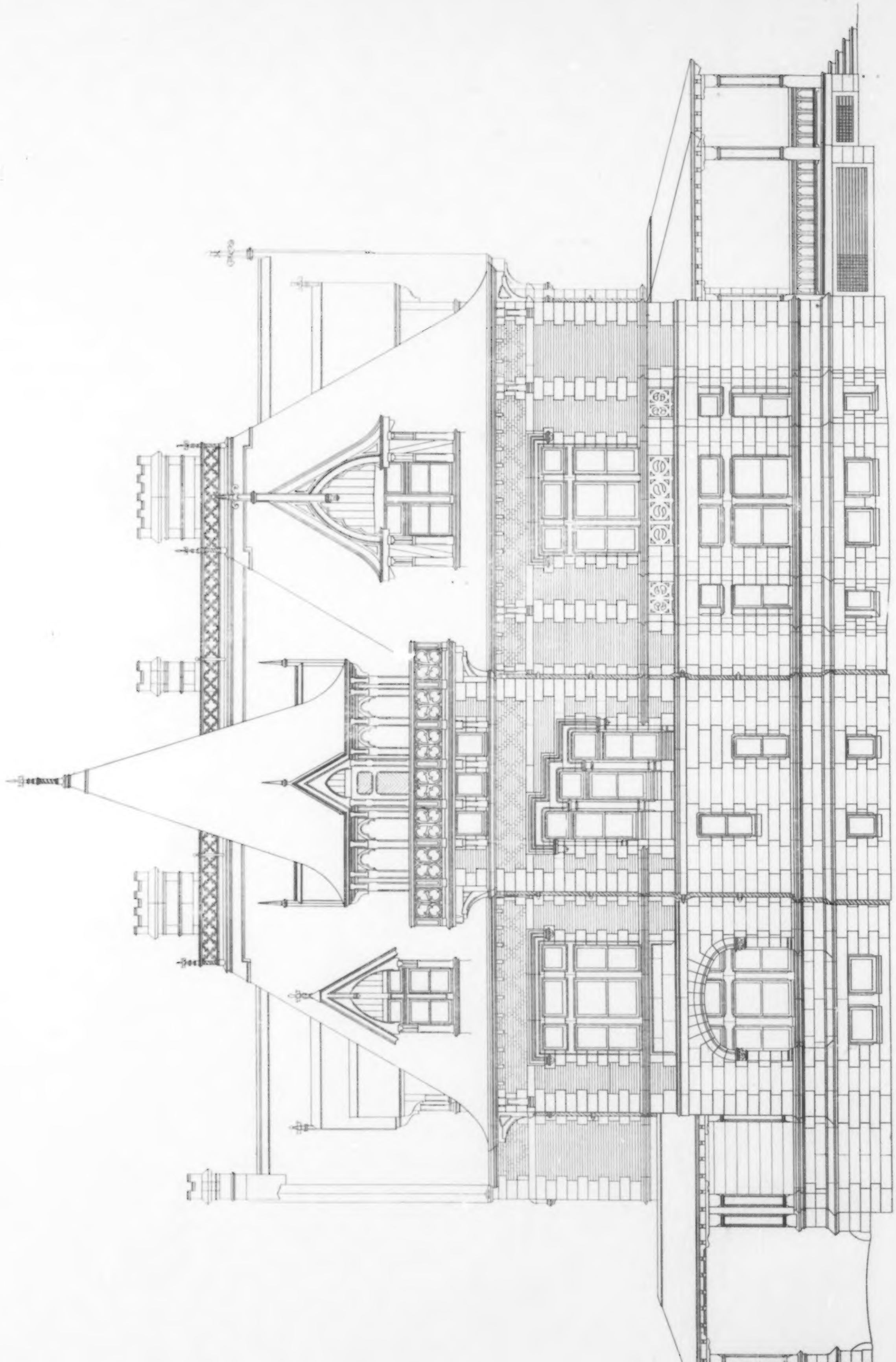
Second Floor Plan



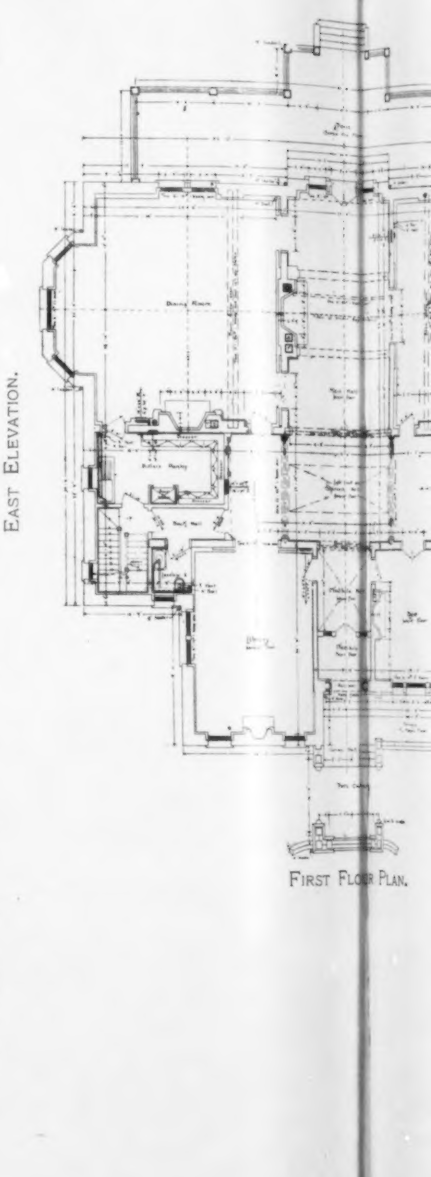
Front Elevation.

LIBRARY, WAYLAND, MASS.

CABOT, EVERETT & MEAD, Architects.

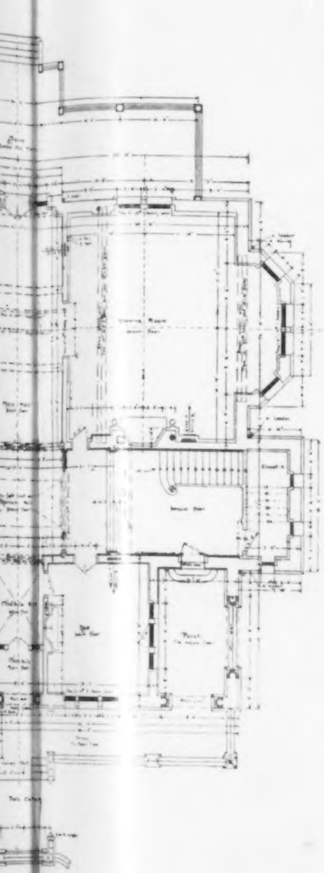


EAST ELEVATION.

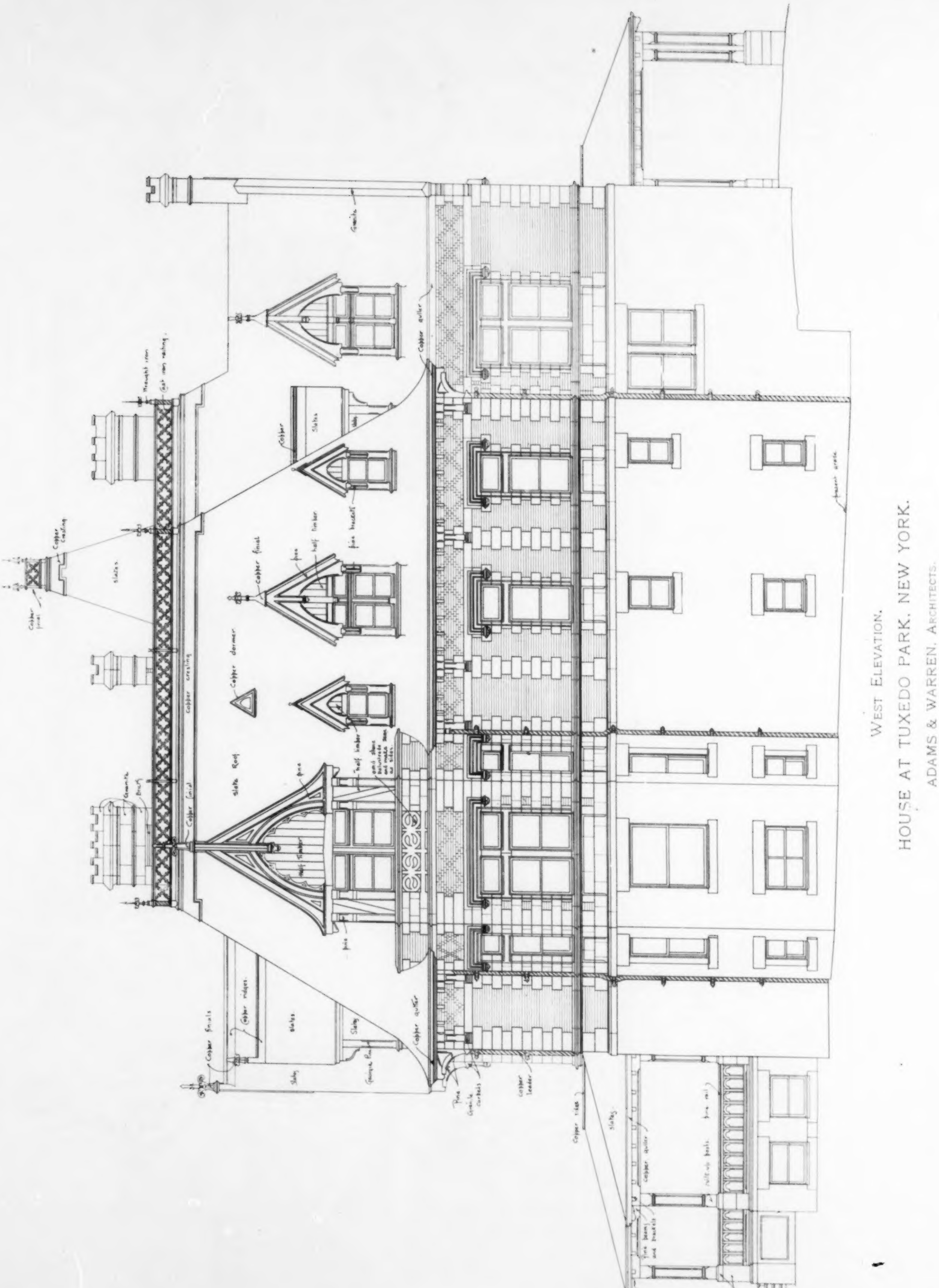


FIRST FLOOR PLAN.

PLATES 90 and 95.



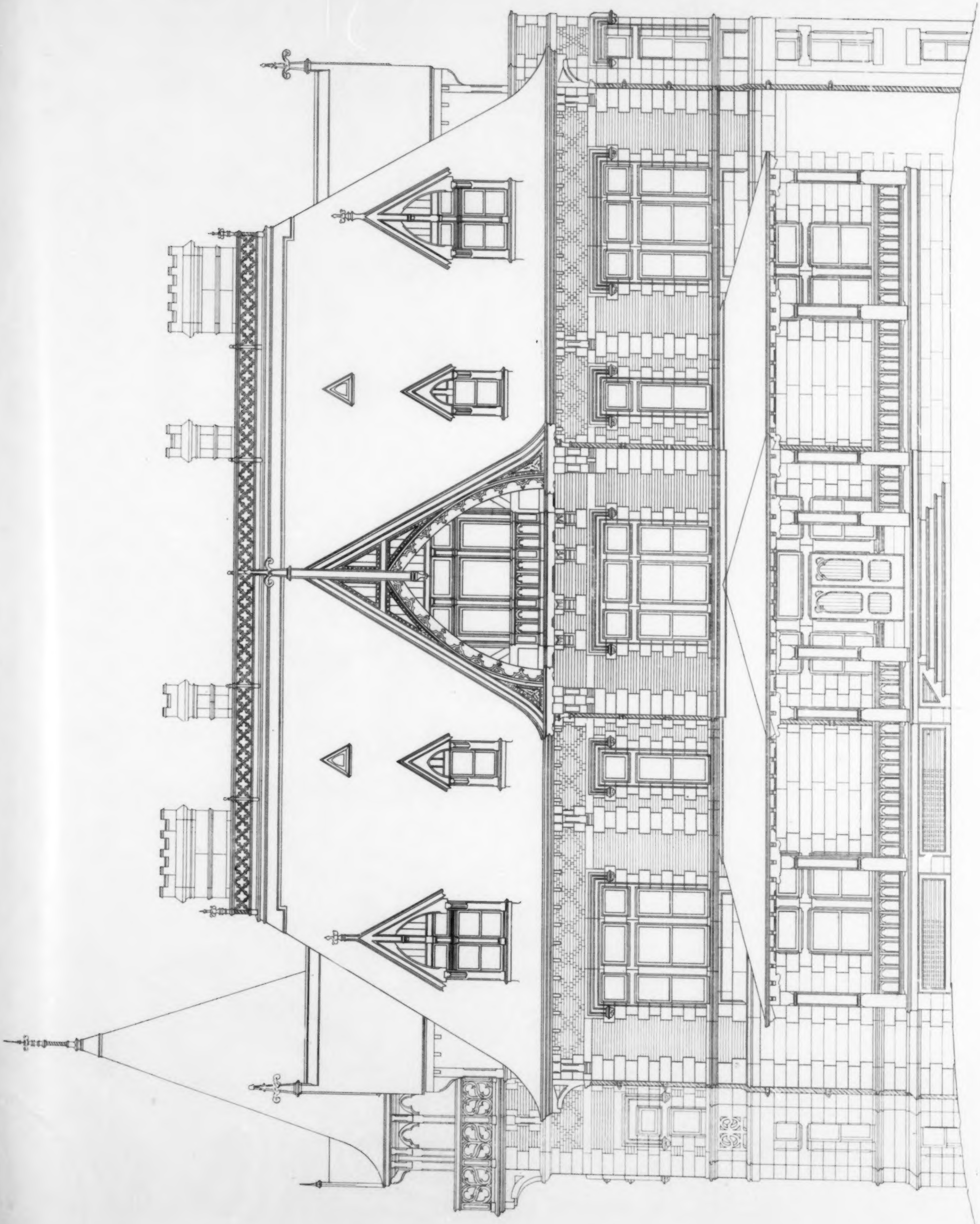
FLOOR PLAN.



WEST ELEVATION.

HOUSE AT TUXEDO PARK, NEW YORK.

ADAMS & WARREN, ARCHITECTS.



SOUTH ELEVATION.
HOUSE AT TUXEDO PARK, NEW YORK.
ADAMS & WARREN, ARCHITECTS.

Drawings by Adams & Warren

1899

Plates. Drawings by Adams & Warren.
Drawings by Cabot, Everett & Mead.
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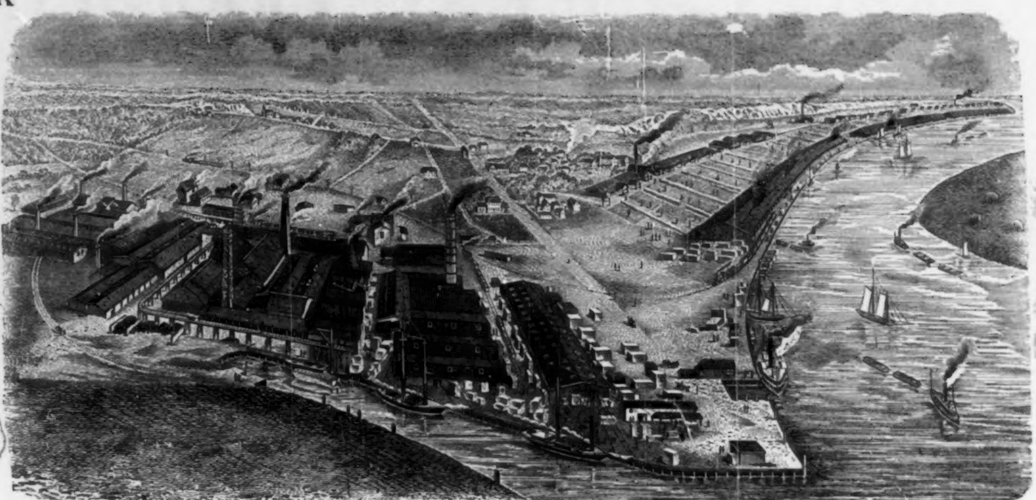

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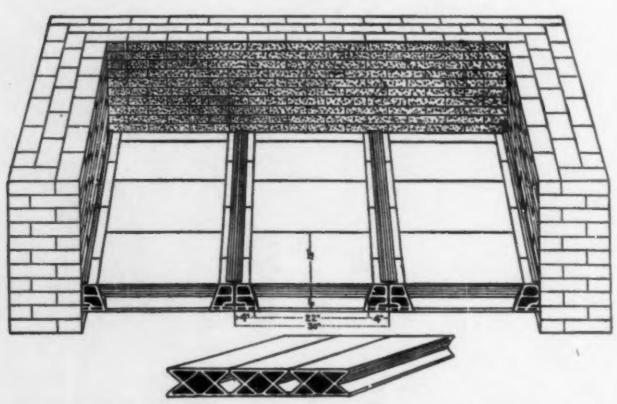

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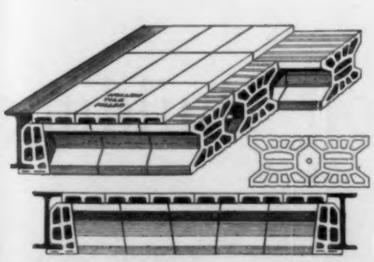
This arch is composed of three tiles: two abutments, or "skew-backs," which fit the beams (thoroughly protecting their lower flanges), and one center or "key tile," set between 5 in. or 6 in. deep beams. The tie-rods going between openings on side of brick and allowing for same, the cutting of tiles becomes unnecessary.



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25 per cent. stronger and lighter than any other method.

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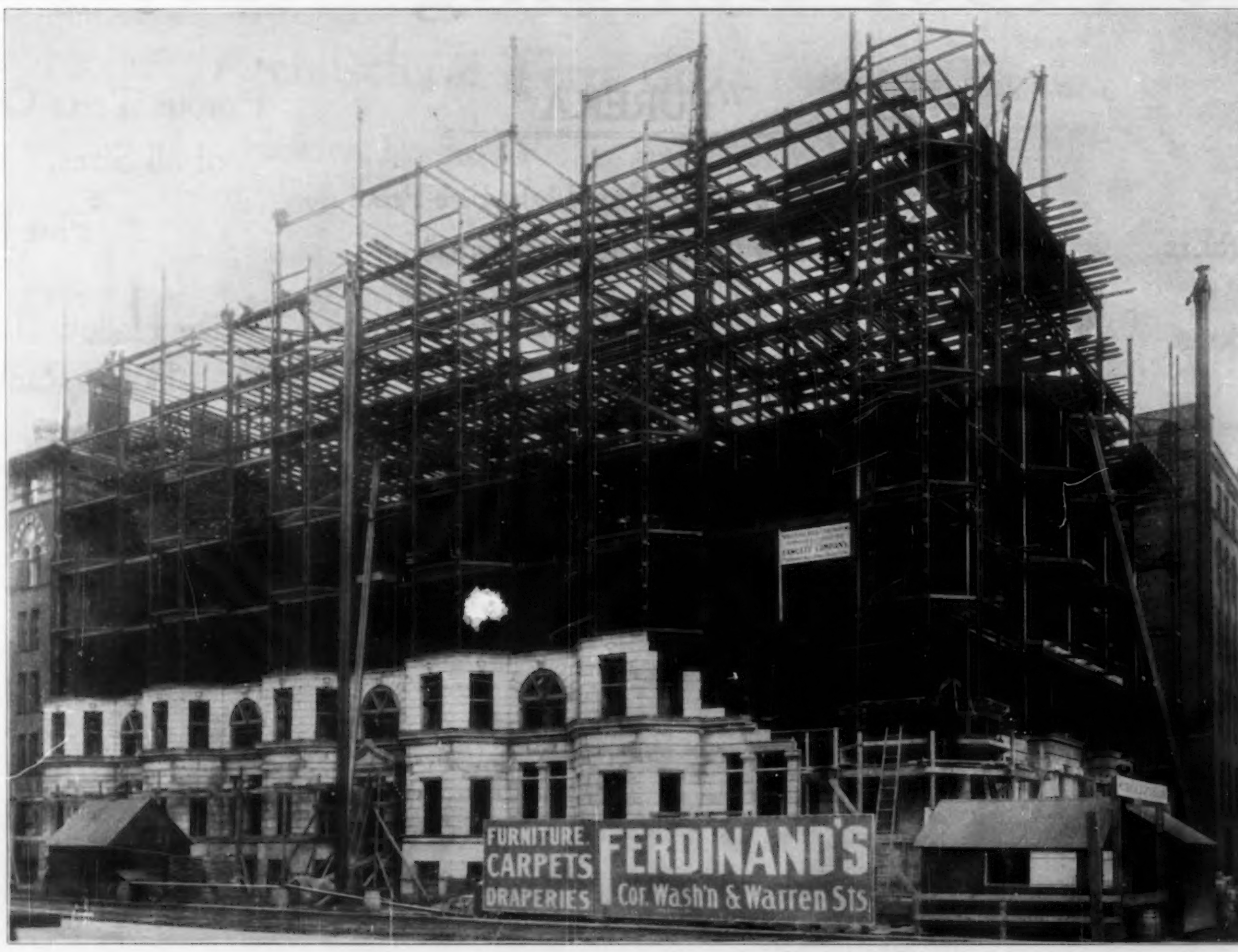

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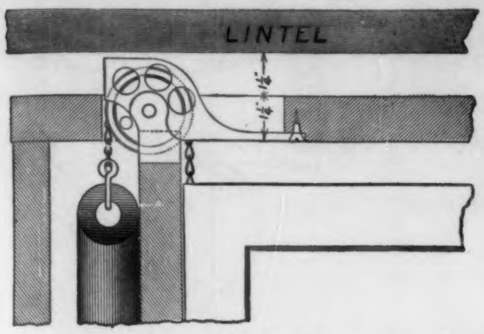

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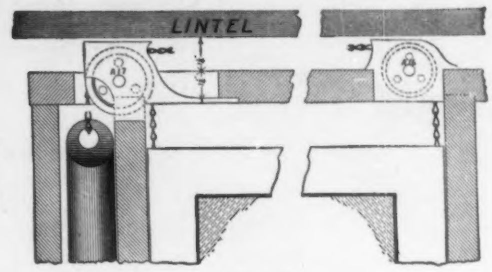

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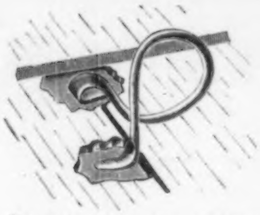

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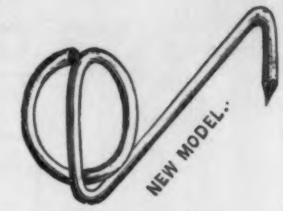
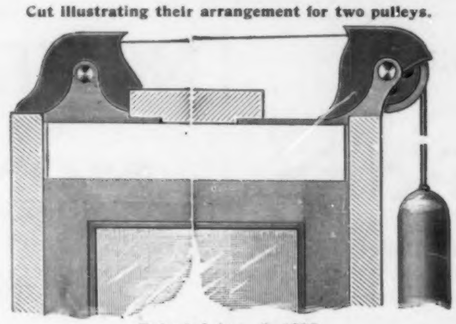


Shull's Mullion Frame Pulleys.

Cut illustrating their arrangement for two pulleys.



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This pulley is designed to do away with the mullion pocket room in a twin window. By this arrangement sashes are operated by one weight, with the same results as in the use of two weights, securing from 4 to 6 ins. more glass space than by the ordinary method. We advocate the Mullion Pulley for tape, but have them for rope or chain if desired.

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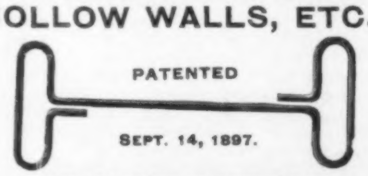
The Cleveland Patent Steel Wall Ties,

FOR

BONDING FACE BRICK, HOLLOW WALLS, ETC...

Perfectly Flat.



Galvanized or Japanned.

MANUFACTURED EXCLUSIVELY BY

THE CLEVELAND WIRE SPRING COMPANY,

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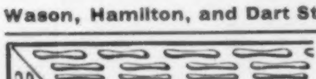
Wason, Hamilton, and Dart Sts., CLEVELAND, OHIO.

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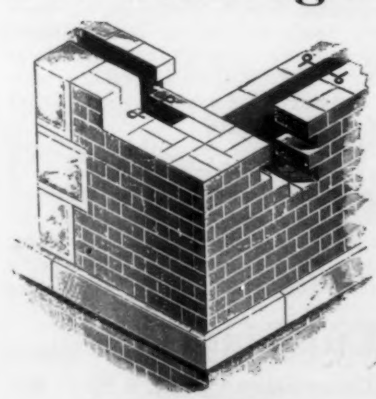

Hollow Wall Bonded with Morse Drip Wall Ties.

The best and only perfect method is the

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Adds Strength.
Excludes all Moisture.
Simple and Cheap.

UNEQUALED FOR

Hospitals, Schools, Churches, Residences, and Public Buildings.

Samples and Catalog on request.

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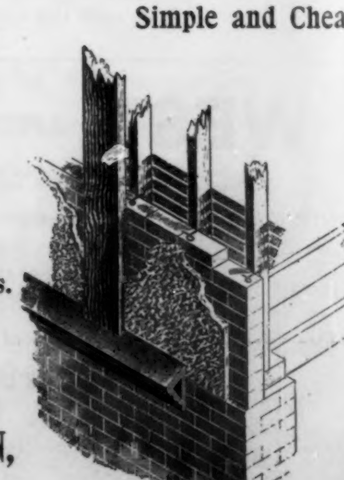
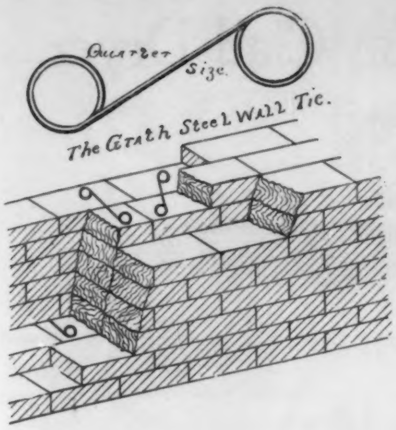


Brick Veneer Wall Bonded with Morse Veneer Ties.



The Grath
STEEL
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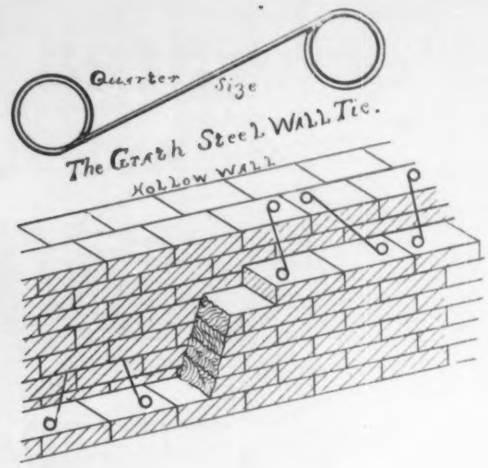

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Perfectly Flat and Rigid and Impossible to Pull Out.

The Only Tie with Circular Ends.

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The Only Tie which Holds ALL over and forms a WEDGE impossible to Pull Out.

Superiority over ALL other Ties seen at a glance.

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ILLINOIS SUPPLY & CONSTRUCTION CO.

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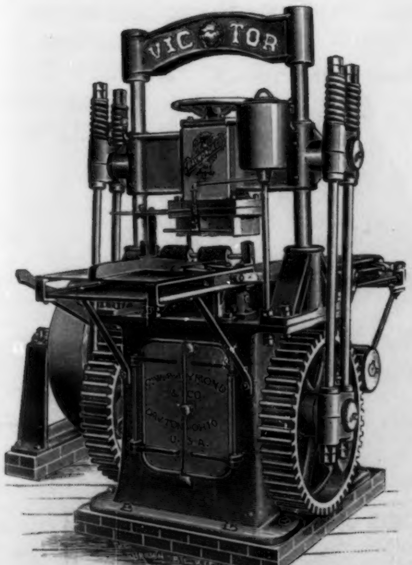

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Brick Machinery made by us produces the highest attainable results.

The pinnacle of perfection is reached by Raymond Brick Machinery.

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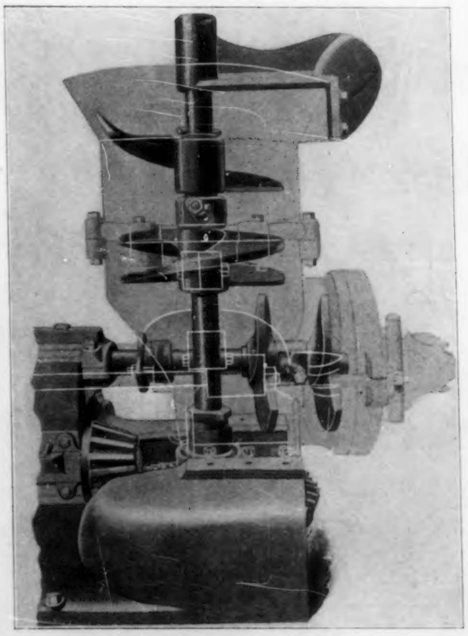

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